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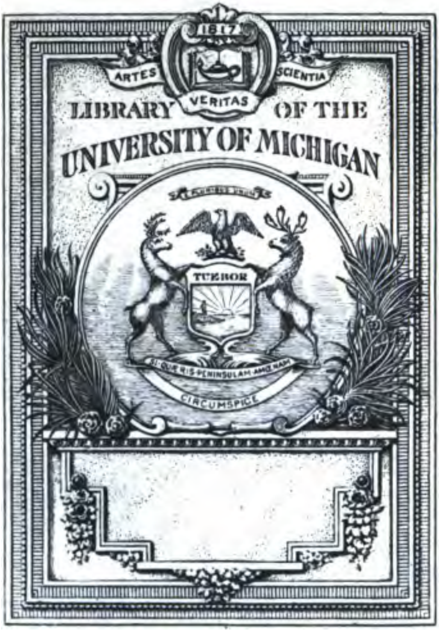
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Wm. L. Gray

THE

ELEMENTS OF LOGIC.

IN FOUR BOOKS.

BOOK I....Of the original of our ideas, their various divisions, and the manner in which they contribute to the increase of knowledge ; with a philosophical account of the rise, progress, and nature of human language.

BOOK II....Of the grounds of human judgment, the doctrine of propositions, their use in reasoning, and division into self-evident and demonstrable.

BOOK III....Of reasoning and demonstration, with their application to the investigation of knowledge, and the common affairs of life.

BOOK IV....Of the methods of invention and science, where the several degrees of evidence are examined, the notion of certainty is fixed and stated, and the parts of knowledge in which it maybe attained,demonstrated at large.

DESIGNED PARTICULARLY FOR
YOUNG GENTLEMEN AT THE UNIVERSITY ;
AND TO PREPARE THE WAY TO THE STUDY OF PHILOSOPHY AND THE MATHEMATICS.

BY WILLIAM DUNCAN,
Professor of Philosophy in Marishal College, Aberdeen.

Doctrina sed vim promovet insitam ;
Rectique cultus pectora roborant........Hor.

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TO THE

RIGHT HONORABLE

STEPHEN POYNTZ, ESQ.

SIR,

If I take this opportunity of publishing to the world the esteem I have for a character to which learning is so greatly indebted, I hope you will not think yourself injured by such a declaration from a man that honours you, and who looks upon the liberty of putting the following work under your patronage, as one of the happy incidents of his life.

From the first moment I formed the design of it, I had it in my. thoughts to address it to you ; and indeed what could be more natural, than that I should be ambitious of inscribing a treatise upon the elements of philosophy, to one, who has so eminently distinguished himself by his extensive knowledge in that, as well as all the other branches of human learning ?

Your great abilities in every kind, have deservedly recommended you to the notice of your king and country, and occasioned your being courted and importuned to accept those high offices of state, which others pursue with so much eagerness, and find it often difficult to obtain, by all the arts and endeavours of ambition. Nor have your talents been confined to the view of your country alone. Foreign nations have seen and admired you, and still speak with the greatest applauses of your wise and able conduct, when it was your province to act as a British minister abroad.

But the qualities of a great statesman are not those alone by which you have rendered yourself illustrious. The virtues of private life no less actuate and adorn your whole behaviour, and add a new dignity to the high station to which your merit has raised you. Affability, complacency of manners, and, above all, an extensive humanity and benevolence, which takes pleasure in doing good, are distinguishing parts of your character, and have contributed no less than your other extraordinary endowments, to that universal acknowledgment which is paid you by your country.

That you may long live to be an ornament and blessing to the nation, and to enjoy the pleasure which arises from a consciousness of the esteem and approbation of all good men, is the sincere and hearty prayer of,

Sir, Your most obliged, and

Most obedient, Humble Servant,

W. DUNCAN.

INTRODUCTION.

Sec. I.—*Importance of the Knowledge of ourselves.*

OF all the human sciences, that concerning man is certainly the most worthy of man, and the most necessary part of knowledge. We find ourselves in this world surrounded with a variety of objects: we have powers and faculties fitted to deal with them, and are happy or miserable in proportion as we know how to frame a right judgment of things, and shape our actions agreeably to the circumstances in which we are placed. No study, therefore, is more important than that which introduces us to the knowledge of ourselves. Hereby we become acquainted with the extent and capacity of the human mind; and learning to distinguish what objects it is suited to, and in what manner it must proceed in order to compass its ends, we arrive by degrees, at that justness and truth of understanding, which is the great perfection of a rational being.

Sec. II.—*Different gradation of Perfection in things.*

If we look attentively into things, and survey them in their full extent, we see them rising one above another in various degrees of eminence. Among the inanimate parts of matter, some exhibit nothing worthy our attention, their parts seem as it were jumbled together by mere chance, nor can we discover any beauty, order, or regularity in their composition. In others we discern the finest arrangement, and a certain elegance of contexture, that makes us affix to them a notion of worth and excellence. Thus metals and precious stones are conceived as far surpassing those unformed masses of earth that lie every where exposed to view. If we trace nature onward, and pursue her through the vegetable and animal kindoms, we find her still multiplying her perfections, and rising, by a just gradation, from mere mechanism to perception, and from perception, in all its various degrees, to reason and understanding.

Sec. III.—*Usefulness of Culture, and particularly of the Study of Logic.*

But though reason be the boundary by which man is distinguished from the other creatures that surround him, yet we are far from finding it the same in all. Nor is this inequality to be wholly ascribed to the original make of men's minds, or the difference of their natural endowments For if we look abroad into the several nations of the world, some are overrun with ignorance and barbarity; others flourish in learning and the sciences; and what is yet more remarkable, the same people have, in different ages, been distinguished by these very opposite characters. It is therefore by culture, and a due application to the powers of our minds, that we increase their capacity, and carry human reason to perfection. Where this method is followed, knowledge and strength of understanding never fail to ensue; where it is neglected, we remain ignorant of our own worth; and those latent qualities of the soul, by which she is fitted to survey this vast fabric of the world, to scan the heavens, and search into the causes of things, lie buried in darkness and obscurity. No part of knowledge, therefore, yields a fairer prospect of improvement, than that which takes account of the understanding, examines its powers and faculties, and shows the ways by which it comes to attain its various notions of things. This is properly the design of *Logic*; which may be justly styled the history of the human mind, inasmuch as it traces the progress of our knowledge, from our first and simple perceptions, through all their different combinations, and all those numerous deductions that result from variously comparing them one with another. It is thus that we are let into the natural frame and contexture of our own minds, and learn in what manner we ought to conduct our thoughts, in order to arrive at truth, and avoid error We see how to build one discovery upon another, and, by preserving the chain of reasonings uniform and unbroken, to pursue the relations of things through all their labyrinths and windings, and at length exhibit them to the view of the soul, with all the advantages of light and conviction.

Sec. IV.—*Operations of the Mind.*

But as the understanding, in advancing from one part of knowledge to another, proceeds by a just gradation, and exerts various acts, according to the different progress it has made, logicians have been careful to note these several steps, and have distinguished them in their writings by the name of the erations of the mind. These they make four in number, and eeably to that have divided the whole system of logic into four parts, in which these acts are severally explained, and the conduct and procedure of the mind, in its different stages of improvement, regulated by proper rules and observations. Now, in order to judge how far logicians have followed nature, in this distinction of the powers of the understanding, let us take a short view of the mind, and the manner of its progress, according to the experience we have of it in ourselves, and see whither the chain of our own thoughts will without constraint lead us.

Sec. V.—*Perception.*

First, then, we find ourselves surrounded with a variety of objects, which, acting differently on our senses, convey distinct impressions into the mind, and thereby rouse the attention and notice of the understanding. By reflecting, too, on what passes within us, we become sensible of the operations of our own minds, and attend to them as a new set of impressions. But in all this there is only bare *consciousness*. The mind, without proceeding any further, takes notice of the impressions that are made upon it, and views things in order as they present themselves one after another. This attention of the understanding to the objects acting upon it, whereby it becomes sensible of the impressions they make, is called by logicians, *perception*; and the notices themselves, as they exist in the mind, and are there treasured up to be the materials of thinking and knowledge, are distinguished by the name of *ideas*.

Sec. VI.—*Judgment.*

But the mind does not always rest satisfied in the bare view and contemplation of its ideas. It is of a more active and busy nature, and likes to be assembling them together, and comparing them one with another. In this complicated view of things, it readily discerns, that some agree and others disagree, and joins or separates them according to this perception. Thus, upon comparing the idea of two added to two, with the idea of four, we, at first glance, perceive their agreement, and thereupon pronounce that two and two are equal to four. Again, that white is not black, that five is less than seven, are truths to which we immediately assent, as soon as we compare those ideas together. This is the first and simplest act of the mind, in determining the relation of things, when, by a bare attention to its own ideas, comparing any two of them together, it can at once see how far they are connected or disjoined. The knowledge thence derived is called *intuitive*, as requiring no pains or examination; and the act of the mind assembling its ideas together, and joining or disjoining them, according to the result of its *perceptions*, is what logicans term *judgment*.

Sec. VII.—*Reasoning*.

Intuition affords the highest degree of certainty; it breaks in with an irresistible light upon the understanding, and leaves no room for doubt or hesitation. Could we in all cases, by thus putting two ideas together, discern immediately their agreement or disagreement, we should be exempt from error, and all its fatal consequences. But it so happens that many of our ideas are of such a nature, that they cannot be thus examined in concert, or by any immediate application one to another; and then it becomes necessary to find out some other ideas that will admit of this application, that by means of them we may discover the agreements we search for. Thus the mind, wanting to know the agreement or disagreement in extent between two enclosed fields, which it cannot so put together as to discover their equality or inequality by any immediate comparison, casts about for some intermediate idea, which, by being applied first to the one, and then to the other, will discover the relation it is in quest of. Accordingly, it assumes some stated length, as a yard, &c. and measuring the fields one after the other, comes by that means to the knowledge of the agreement or disagreement in question. The intervening ideas made use of on these occasions, are called *proofs*; and the exercise of the mind in finding them out, and applying them for the discovery of the truths it is in search of, is what we term *reasoning*. And here let it be observed, that the knowledge gained by reasoning is a deduction from our intuitive perceptions, and ultimately founded on them. Thus in the case before mentioned, having found by measuring, that one of the fields makes three-score square yards, and the other only fifty-five, we thence conclude, that the first field is larger than the second. Here the two first perceptions are plainly intuitive, and gained by an immediate application of the the measure of a yard to the two fields, one after another. The conclusion, though it produces no less certain knowledge, yet differs from the others in this that it is not obtained by an immediate comparison of the ideas contained in it, one with another, but is a deduction from the two preceding judgments, in which the ideas are severally compared with a third and their relation thereby discovered We see, therefore, that reasoning is a much more complicated act of the mind than simple judgment, and necessarily presupposes it, as being ultimately founded on the perceptions thence gained, and implying the various comparisons of them one with another. This is the great exercise of the human faculties, and the chief instrument by which we push on our discoveries, and enlarge our knowledge. A quickness of mind to find out intermediate ideas, and apply them skilfully in determining the relations of things, is one of the principal distinctions among men, and that which gives some so remarkable a superiority over others, that we are apt to look upon them as creatures of another species.

Sec. VIII.—*Method.*

Thus far we have traced the progress of the mind in thinking, and seen it rising by natural and easy steps from its first and simple perceptions, to the exercise of its highest and most distinguishing faculty. Let us now view it in another light, as enriched with knowledge, and stored with a variety of discoveries, acquired by a due application of its natural powers. It is obvious to consider it in these circumstances, as taking a general survey of its whole stock of intellectual acquisitions, disposing them under certain heads and classes and tying them together, according to those connexions and dependencies it discerns between them. It often happens, in carrying on our inquiries from subject to subject, that we stumble upon unexpected truths, and are encountered by discoveries which our present train of thinking gave no prospect of bringing in our way. A man of clear apprehension, and distinct reason, who, after due search and examination, has mastered any part of knowledge, and even made important discoveries in it, beyond what he at first expected, will not suffer his thoughts to lie jumbled together in the same confused manner as chance offered them : he will be for combining them into a regular system; where their mutual dependence may be easily traced, and the parts seem to grow one out of another. This is that operation of the mind, known by the name of *disposition* or *method*, and comes in the last in order, according to the division of the logicians, as presupposing some tolerable measure of knowledge, before it can have an opportunity of exerting itself in any extensive degree.

Sec. IX.—*Perception and Judgment terms of a very extensive signification.*

We see, then, that this fourfold distinction of the powers of the mind, in perception, judgment, reasoning, and disposition, as well as the order in which they are placed, have a real foundation in nature, and arise from the method and procedure of our own thoughts. It is true, there are many other actions and modifications of the understanding, besides those above mentioned, as believing, doubting, assenting, &c. but these are all implied in the act of reasoning, in the like manner, as comprehending, abstracting, remembering, may be referred to the first operation of the mind, or perception. This will appear more fully in the sequel, when we come to handle the several parts of logic separately; at present we shall content ourselves with this general account of things; only it seems necessary to observe, that *perception* and *judgment*, in the propriety of the English tongue, have a much more extensive signification than logicians commonly allow them. We not only perceive the ideas in our own minds, but we are said also to perceive their agreement or disagreement; and hence arise the common phrases of intuitive perceptions, perceptions of truth, and of the justness of arguments or proofs; where it is manifest, that the word is applied not only to our judgments, but also to our reasonings. In a word, whatever comes under the view of the mind, so as to be distinctly represented and taken notice of, whether an idea, proposition, chain of reasoning, or the order and connexion of things, is thereby rendered an object of perception, and gives employment to this first and most simple of our faculties. In like manner, the word *judgment* is seldom, in common discourse, confined to obvious and self evident truths. It rather signifies those conjectures and guesses that we form, in cases which admit not of undoubted certainty, and where we are left to determine by comparing the various probabilities of things. Thus a man of sagacity and penetration, who sees far into the humours and passions of mankind, and seldom mistakes in the opinions he frames of characters and actions, is said to judge well, or think judiciously. For these reasons, it might not be improper to change the common names of the two first operations of the mind, calling the one *simple apprehension*, and the other *intuition*; which two words seem better to express their nature, and the manner in which they are conversant about their several objects. This accuracy of distinguishing, where there is any the least difference, is in a peculiar manner necessary in a treatise of logic, as it is the professed design of that science, to teach us how to form clear and distinct notions of things, and thereby avoid being misled by their similitude or resemblance.

Sec. X.—*Logic divided into Four Parts. Its Usefulness and Excellency.*

Having thus given a general idea of the four operations of the mind, and traced their connexion and dependence upon one another, I would next observe, that in consequence of this division of the powers of the understanding, *logic* is also divided into four parts, which treat severally of these acts, and give rules and directions for their due conduct and regulation. The operations themselves we have from nature; but how to exert them justly and employ them with advantage in the search of truth, is a knowledge that may be acquired by study and observation. It is certain that we meet with false reasonings as well as just. Some men are distinguished by an accuracy of thinking, and a happy talent of unravelling and throwing light upon the most obscure and intricate subjects. Others confound the easiest speculations; their understandings seem to be formed awry, and they are incapable of either conceiving clearly themselves, or making their thoughts intelligible to others. If then we set ourselves carefully to observe what it is that makes the one succeed so well, and how the others come to miscarry, these remarks will furnish us with an art of the highest use and excellency in the conduct of life. Now this is the precise business of *logic*—to explain the nature of the human mind, and the proper manner of conducting its several powers, in order to the attainment of truth and knowledge. It lays open those errors and mistakes we are apt, through inattention, to run into, and teaches us how to distinguish between truth, and what carries only the appearance of it. By this means, we grow acquainted with the nature and force of the understanding, see what things lie within its reach, where we may attain certainty and demonstration, and when we must be contented with bare probability These considerations sufficiently evince the usefulness and benefit of this science, which ought to be established as the foundation and ground-work of all our other knowledge, if we really wish to succeed in our inquiries But we shall now proceed to treat of its parts separately, according to the division given of them above.

ELEMENTS OF LOGIC.

BOOK I.

Of Simple Apprehension, or Perception.

CHAP I.

OF THE ORIGINAL OF OUR IDEAS.

SECTION I.

Simple Apprehension and Ideas.

THE first thing we observe, when we take a view of what passes within us, is, that we are capable of receiving impressions from a variety of objects; that distinct notices are thereby conveyed into the understanding; and that we are conscious of their being there. This attention of the mind to the objects acting upon it, is what we call *simple apprehension*, and is, in fact, the mind itself taking a view of things, as represented to it by its own consciousness. It is by this means that we come to be furnished with all those ideas about which our thoughts are employed. For being sensible of the impressions made upon us, and attending to the perceptions they bring, we can renew them again upon occasion, even when the objects that first produced them are removed. Now, our ideas are nothing else but these renewed representations of what we have at any time perceived and felt, by means of which things are again brought under the view of the mind, and seem to have a kind of existence in it. It is true, we can upon many occasions combine our ideas variously together, and thereby form to ourselves representations of things that never had an existence in nature, as when we fancy a centaur, or a golden mountain; but it is still certain, that the original ideas, out of which these are made, are such as have been conveyed into the mind by some former impressions. It remains therefore to inquire how we come by our first notions and perceptions of things. Whence does the understanding derive these original impressions and characters, which it can combine in so many different ways, and represents to itself under such infinite varieties? To this I answer, that if we attend carefully to what passes in our minds, we shall observe two inlets of knowledge, from whence, as from two fountains, the understanding is supplied with all the materials of thinking.

SECTION II.

All our original Ideas derived either from Sensation,

First, outward objects, acting upon our senses, rouse in us a variety of perceptions, according to the different manner in which they affect us. It is thus that we acquire ideas of light and darkness, heat and cold, sweet and bitter, and all those other impressions which we term sensible qualities. This great source and inlet of knowledge is commonly distinguished by the name of sensation, as comprehending all the notices conveyed into the mind, by impulse made upon the organs of sense.

SECTION III.

Or, Reflection.

But these ideas, numerous as they are, are wholly derived to us from without: there is therefore yet another source of impressions, arising from the mind's attention to its own acts, when, turning inwards upon itself, it takes a view of the perceptions that are lodged there, and the various ways in which it employs itself about them. For the ideas furnished by the senses, give the mind an opportunity of exerting its several powers; and as all our thoughts, under whatever form they appear, are attended with consciousness, hence the impressions they leave, when we come to turn the eye of the soul upon them, enrich the understanding with a new set of perceptions, no less distinct than those conveyed in by the senses. Thus it is that we get ideas of thinking, doubting, believing, willing, &c. which are the different acts and workings of our minds, represented to us by our own consciousness. This second source of ideas is called *reflection*, and evidently presupposes sensation; as the impressions it furnishes are only of the various powers of the understanding, employed about perceptions already in the mind.

SECTION IV.

Rise and Progress of Human Knowledge.

These considerations, if we duly attend to them, will give us a clear and distinct view of the natural procedure of the human intellect, in its advances to knowledge. We can have no perception of the operations of our own minds, until they are exerted; nor can they be exerted before the understanding is furnished with ideas about which to employ them: and as these ideas, that give the first employment to our faculties, are evidently the perceptions of sense, it is plain that all our knowledge must begin here. This, then, is the first capacity of the human mind, that it is fitted to receive the impressions made upon it by outward objects affecting the senses; which impressions, thus derived into the understanding, and *there lodged*, for the view of the soul, employ it in various acts of perceiving, remembering, considering, &c. all which are attended with an internal feeling and consciousness. And this leads us to the second step the mind takes in its progress towards knowledge, viz. that it can, by its own consciousness, represent to itself these its several workings and operations, and thereby furnish the understanding with a new stock of ideas. From these simple beginnings, all our discoveries take their rise; ~~for the mind,~~ thus provided with its original characters and notices of things, has a power of combining, modifying, and examining them in an infinite variety of lights, by which means it is enabled to enlarge the objects of its perception, and finds itself possessed of an inexhaustible stock of materials. It is in the various comparison of these ideas, according to such combinations of them as seem best to suit its ends, that the understanding exerts itself in the arts of judging and reasoning, by which the capacious mind of man pushes on its views of things, adds discovery to discovery, and often extends its thoughts beyond the utmost bounds of the universe. Thus we see, as it were, at one glance, the whole progress of the soul, from the very first dawnings of perception, till it reaches the perfection of human knowledge; nor shall we, among all its vast stock of discoveries, or that infinite variety of conceptions whereof they consist, be able to find one original idea which is not derived from sensation or reflection, or one complex idea which is not made up of those original ones.

SECTION V.

Division of our Ideas into Simple and Complex.

Having thus shown how the mind comes to be first furnished with ideas, we shall next proceed to the consideration of the ideas themselves, and endeavour to give such an account of them, as will best serve to explain their several appearances, and the manner in which they are formed. It is evident, from what has been said above, that they all fall naturally under these two heads: first, those original impressions that are conveyed into the mind by sensation and reflection, and which exist there, simple, uniform, and without any shadow of variety. Secondly, those more complex notions of things, that result from the various combinations of our simple ideas, whether they are conceived to exist of themselves, in any particular subject, or are united and joined together by the mind enlarging its conceptions of things, and pursuing the ends and purposes of knowledge. These two classes comprehend our whole stock of ideas; and, when considered separately, in that order wherein they most naturally seem to offer themselves to our thoughts, will, I hope, give such a view of the conduct and manner of the mind, as may contribute not a little to introduce us to an acquaintance with ourselves, and make us sensible of the capacity and extent of the human intellect. We proceed, therefore, to a more particular account of this division of our ideas.

CHAP. II.

OF SIMPLE IDEAS.

SECTION I.

Simple Ideas, what.

THE first class of our ideas are those which I distinguish by the name of simple perception; because they exist in the mind under one uniform appearance, without variety or composition. For though external objects convey at once into the understanding many different ideas, all united together, and making as it were one whole; yet the impressions themselves are evidently distinct and are conceived by the mind, each under a form peculiar to itself. Thus the ideas of colour, extension, and motion, may be taken in at one and the same time, from the same body; yet these three perceptions are as distinct in themselves as if they all proceeded from different objects, or were exhibited to our notice at different times. We are therefore carefully to distinguish between our simple and primitive conceptions and those different combinations of them, which are often suggested to the mind by simple objects acting upon it. The first constitute our original notices of things, and are not distinguishable into different ideas, but enter by the senses simple and unmixed. They are also the materials out of which all the others, how complex and complicated soever, are formed; and therefore ought deservedly to be looked on as the foundation and ground-work of our knowledge.

SECTION II.

Simple Ideas of Sensation.

Now if we take a survey of these ideas, and their several divisions and classes, we shall find them all suggested to us, either by our senses, or the attention of the mind to what passes within itself. Thus our notices of the different qualities of bodies, are all of the kind we call simple ideas, and may be reduced to five general heads, according to the several organs which are affected by them. Colours, &c. and sounds are conveyed in by the eyes and ears; tastes and smells by the nose and palate; and heat, cold, solidity, &c. by the touch. Besides these, there are others which make impressions on several of our senses, as extension, figure, rest and motion, &c. the ideas of which we receive into our minds both by seeing and feeling.

SECTION III.

Simple Ideas of Reflection, &c.

If we next turn our view upon what passes within ourselves, we shall find another set of simple ideas arising from our consciousness of the acts and operations of our own minds. Perception or thinking, and volition or willing, are what every man experiences in himself, and cannot avoid being sensible of. I shall only observe further, that besides all the above-mentioned perceptions, there are others that come into our minds by all the ways of sensation and reflection; such are the ideas of pleasure and pain, power, existence, unity, succession, &c. which are derived into our understandings both by the action of objects without us, and the consciousness of what we feel within. It is true, some of these ideas, as of extension and duration, cannot be conceived altogether without parts, nevertheless, they are justly ranked among our simple ideas; because their parts being all of the same kind, and without the mixture of any other idea, neither of them can be resolved into two distinct and separate conceptions. Thus they still answer the definition given above, of being one uniform appearance in the mind, with variety or plurality. But to prevent confounding our simple ideas of space and duration, with those complex modes of them marked out by the several measures commonly in use, as yards, miles, days, years, &c. it may perhaps be most proper to consider the least portions of either whereof we can form a clear and distinct perception, as the simple ideas of that kind out of which all their other modes and combinations are formed. Such an instant, or point, may be conceived to be the same in respect of duration or space, as unity is in respect of numbers; and will serve best to show how, by a continued addition or repetition, our more enlarged and complex ideas are made up.

SECTION IV.

Simple Ideas have no Admission but by the proper Inlets of Nature.

Having thus given a general view of our simple ideas, I have still two observations to make concerning them. The first is, that they are such as can only be conveyed into the mind by the proper channels and avenues provided by nature; insomuch, that if we are destitute of any of those inlets, by which the impressions that produce them are wont to be admitted, all the ideas thence arising are absolutely lost to us; nor can we, by any quickness of understanding, find a remedy for this want. A man born blind is incapable of the ideas of light and colours; in like manner as one who is deaf can form no notion or conception of sounds. Hence it appears, that these our simple ideas are just such as nature has furnished them, and have no dependence on our will; we can neither destroy them when in the understanding, nor fashion or invent any new one, not taken in by the ordinary means of perception. So that we here see the utmost bounds of human knowledge, which, however mighty and enlarged, cannot exceed the limits of those our simple original ideas, and their various combinations.

SECTION V.

They furnish ample Materials of Knowledge.

And this leads me to the second observation I proposed to make, which is, that though the mind cannot, in multiplying its conceptions of things, advance one step beyond the materials furnished it by sense and consciousness: yet as it has a power of combining, modifying and enlarging them, in all the different ways in which they can be put together, it therefore finds itself in possession of an inexhaustible treasure of ideas, sufficient to employ it to the full extent of all its powers, and furnish matter for all those various opinions, fancies, and views of things, that make up the subject of its thoughts and contemplations. Let us but reflect upon the single idea of unity or one, and observe what a variety of combinations are formed, by continually adding it to itself; insomuch that the understanding finds no stop or boundary, in its progress from number to number. In what an infinity of different lights may extension alone be considered! what limit can be set to that endless diversity of figures; which it is in the power of the imagination to fashion and represent to itself? If to these we add those numberless other combinations that result from variously compounding and comparing the rest of our simple ideas, we shall have little reason to complain of being limited to a scanty measure of knowledge, or that the exercise of the human faculties is confined within narrow bounds. But having traced the progress of the mind through its original and simple ideas, until it begins to enlarge its conceptions by uniting and tying them together; it is now time to take a survey of it as thus employed in multiplying its views, that we may see by what steps it advances from one degree of improvement to another, and how it contrives to manage that infinite stock of materials it finds itself possessed of.

SECTION VI.

The Division of complex Ideas into those of real Existence, and those framed by the Mind.

Whoever attentively considers his own thoughts, and takes a view of the several complicated ideas that from time to time offer themselves to his understanding, will readily observe that many of them are such as have been derived from without, and suggested by different objects affecting his perception; others, again, are formed by the mind itself variously combining its simple ideas, as seems best to answer those ends and purposes it has for the present in view. Of the first kind are all our ideas of substances, as of a man, a horse, a stone, gold. Of the second are those arbitrary collections of things, which we on many occasions put together, either for their usefulness in the commerce of life, or to further the pursuit of knowledge: such are our ideas of stated lengths, whether of duration or space; as hours, months, miles, leagues, &c. which divisions are apparently the creatures of the mind, inasmuch as we often find them different in different countries; a sure sign that they are taken from no certain and invariable standard in nature. Many of our ideas of human actions may be also referred to this head; as treason, incest, manslaughter, &c. which complex notions we do not always derive from an actual view of what these words describe, but often from combining the circumstances of them in our minds, or, which is the most usual way, by hearing their names explained, and the ideas they stand for enumerated. These two classes comprehend all our complex conceptions, it being impossible to conceive any that are not either suggested to the understanding by some real existences, or formed by the mind itself arbitrarily uniting and compounding its ideas. We shall treat of each in order.

CHAP. III.

OF OUR IDEAS OF SUBSTANCES.

SECTION I.

Ideas of Substances, Collections of Simple Ideas, held together by some unknown Support.

The first head of complex ideas mentioned in the foregoing chapter, is that of *substances*, which I choose to handle before the other; because, as will afterwards appear, the notices derived from this source very much help us in forming those arbitrary collections, which make up the second division. For in many of them we take our hints from the reality of things, and combine ideas that actually exist together, though often with an exclusion of others, as will be explained when we come to treat of abstract and universal notions. It has been already observed, that the impressions conveyed into the understanding from external objects, consist for the most part of many different ideas joined together, which all unite to make up one whole. These collections of various ideas, thus co-existing in the same common subject, and held together by some unknown bond of union, have been distinguished by the name of *substances*, a word which implies their subsisting of themselves, without dependence (at least as far as our knowledge reaches) on any other created beings. Such are the ideas we have of gold, iron, water, a man, &c. For if we fix upon any one of these, for instance, gold, the notion under which we represent it to ourselves is that of a body, yellow, very weighty, hard, fusible, malleable, &c. where we may observe that the several properties that go to the composition of gold, are represented to us by clear and evident perceptions; the union too of these properties, and their thereby constituting a distinct species of body, is clearly apprehended by the mind: but when we would push our inquiries farther, and know wherein this union consists, what holds the properties together, and gives them their self-subsistence, here we find ourselves at a loss. However, as we cannot conceive qualities without at the same time supposing some subject in which they adhere, hence we are naturally led to form the notion of a support, which, serving as a foundation for the co-existence and union of the different properties of things, gives them that separate and independent existence under which they are presented to our conception. This support we denote by the name *substance*; and as it is an idea applicable to all the different combinations of qualities that exist any where by themselves, they are accordingly all called substances. Thus a house, a bowl, a stone, &c. having each their distinguishing properties, and being conceived to exist independent one of another, the idea of substance belongs alike to them all.

SECTION II.

The Division of Modes into Essential and Accidental.

In substances, therefore, there are two things to be considered: first, the general notion of self-subsistence, which, as I have said, belongs equally to them all; and then the several qualities, or properties, by which the different kinds and individuals are distinguished one from another. These qualities are otherwise called modes, and have been distinguished into essential and accidental, according as they are perceived to be separable or inseparable from the subject to which they belong. Extension and solidity are essential modes of a stone; because it cannot be conceived without them; but roundness is only an accidental mode; as a stone may exist under any shape or figure, and yet still retain its nature and other properties.

SECTION III.

The Notion of Self-Subsistence inseparable from subsistence.

I might run farther into these divisions and subdivisions, in which logicians have been very fertile; but as they tend little to the advancement of real knowledge, and serve rather to fill the memory with words and their significations, than furnish clear and distinct apprehensions of things, I shall not trouble the reader with them. It is more material to observe, that the change of properties in any substance, though it oft-times changes the nature of that substance, that is, its species or kind; yet it never destroys the general notion of self-existence, but leaves that equally clear and applicable, as before any such alteration happened. Wood, by the application of fire, is turned into charcoal; but charcoal, however different from wood, is still a substance. In like manner, wax may be converted into flame and smoke; a human body will moulder into dust; yet these alterations destroy not their being or existence: they are still substances as before, though under a different form and appearance. In the several experiments made by chemists, bodies undergo many changes and put on successively a great variety of different shapes, and yet, by the skill and address of the operator, they are often brought back to their first and primitive form. What alteration can we suppose the fire, or the application of any other body, to make, unless on the configuration, texture, or cohesion of the minute parts? When these are changed, the body is proportionably changed; when they return to their original state, the body likewise puts on its first and natural appearance.

SECTION IV.

Foundation of the different Species of Corporeal Substances.

All that is essential to matter, therefore, is the cohesion of solid extended parts: but as these parts are capable of innumerable configurations—as their texture may be very various, and the internal constitution thence arising be of consequence extremely different in different bodies—we may from these considerations conceive pretty clearly the source and foundation of all the different species of corporeal substances. Nor is this a notion taken up at random, or one of those chimerical fancies in philosophy, derived rather from a warmth and liveliness of imagination than observations drawn from things themselves. Do we not daily see our food, by the changes it undergoes in the different avenues of the body, converted first into blood, and thence employed in flourishing, building up, and enlarging, the several parts of that wonderful fabric? Rain, descending from the clouds, and mixing with the mould or earth of a garden, becomes aliment for trees of various kinds, puts on a diversity of forms, according to the different channels and conveyances through which it passes; and at last, after innumerable changes and transmutations, sprouts forth in leaves, opens in buds, or is converted into the substance of the tree itself. Can we conceive any greater difference between the component parts of gold, and those of stone, than between the moistened particles of garden mould, and those new forms and figures under which they appear, after they have been thus fashioned by nature for the purposes of growth and nourishment.

SECTION V.

Essence of Substances nothing but the internal structure and constitution;

If this be duly attended to, it will not appear wonderful to assert, that the variety of material substances arises wholly from the different configuration, size, texture, and motion of the minute parts. As these happen to be variously combined, and knit together, under different forms, bodies put on a diversity of appearances, and convey into the mind by the senses all those several impressions, by which they are distinguished one from another—

This internal constitution or structure of parts, from which the several properties that distinguish any substance flow, is called the essence of that substance, and is, in fact, unknown to us, any farther, than by the perceivable impressions it makes upon the organs of sense. Gold, as has been said, is a body yellow, very weighty, hard, fusible, malleable, &c. That inward structure, and conformation of its minute particles, by which they are so closely linked together, and from which the properties above mentioned are conceived to flow, is called its essence; and the properties themselves are the perceivable marks that make it known to us, and distinguish it from all other substances; for our senses are not acute enough to reach its inward texture and constitution. The parts themselves, as well as their arrangement, lie far beyond the utmost penetration of human sight, even when assisted by microscopes, and all the other contrivances of art.

SECTION VI.

Is wholly unknown to us, and serves to distinguish the Species;

Thus, as to the essence or internal constitution of gold, we are wholly in the dark; but many of the properties derived from this essence, make obvious and distinct impressions, as the weight, hardness, and yellow colour, &c. These properties combined together, and conceived as co-existing in the same common subject, make up our complex idea of gold. The same may be said of all the other species of corporeal substances, as lead, glass, water, &c. our ideas of them being nothing else but a collection of the ordinary qualities observed in them.

SECTION VII.

Yet it is rightly presumed to be distinct in all the several kinds.

This, however, ought to be observed, that though the essence or inward structure of bodies is altogether unknown to us, yet we rightly judge, that in all the several species, the essences are distinct. For each species being a collection of properties, which taken together, are different from those of every other species, the conformation of parts, on which these properties depend, must in like manner be different; and this, as we have said, constitutes the essence. Iron and glass are evidently distinct kinds of body; their perceivable qualities have little or nothing common; and therefore the inward structure or constitution from which these qualities flow, cannot be the same in both. But after all, this is the only thing we can with certainty affirm concerning these essences, which lying so wholly in the dark, we shall do well to lay them aside in our reasonings about things, and adhere to those more intelligible and settled ideas acquired by joining together their various properties and powers. For thus only is true knowledge promoted, when we argue from known qualities, and not from a supposed internal constitution, which, however, real in itself, yet comes not within the reach of our faculties, and therefore can never be a ground to us for any discoveries or improvements.

SECTION VIII.

By what steps we arrive at the Notions of Immaterial Substances:

Material substance, as I have said, includes the idea of solid, cohering, extended parts, and is divided into different classes, according to the different impressions made upon the organs of sense. But, besides these sensible ideas received from without, we also experience in ourselves thinking and volition. These actions have no connexion with the known properties of body; nay, they seem plainly inconsistent with some of its most essential qualities. For the mind not only discovers no relation between thinking, and the motion or arrangement of parts; but it also perceives, that consciousness, a simple individual act, can never proceed from a compounded substance, capable of being divided into many. Let us suppose, for instance, a system of matter endowed with thought; then either all the parts, of which this system is composed, must think, which would make it not one, but a multitude of distinct conscious beings; or its power of thinking must arise from the connexion of the parts one with another, their motion and disposition, &c. which, all taken together, contribute to the production of thought. But it is evident, that the motion of parts, and manner of combining them, can produce nothing but an artful structure, and various modes of motion. All machines of human composition, as watches, clocks, &c. however artfully their parts are set together, however complicated their structure—though we conceive innumerable different motions, variously conjoined, and running one into another with an endless diversity, yet never produce any thing but figure and motion. If a clock tells the hour and minute of the day, it is only by the motion of the different hands, pointing successively at the figures marked on the hour-plate for that purpose. We never imagine this to be the effect of thought or intelligence; nor conceive it possible, by any refinement of structure, so to improve the composition, as that it shall become capable of knowledge and consciousness. The reason is plain: thought is something altogether different from motion and figure; there is not the least connexion between them; and therefore it can never be supposed to result from them.

SECTION IX.

Which we otherwise call Spirits.

This then being evident, that intelligence cannot arise from a union or combination of unintelligible parts; if we suppose it to belong to any system of matter, we must necessarily attribute it to all the parts, of which that system is composed; whereby, instead of one, we shall, as was before observed, have a multitude of distinct conscious beings. And because matter, how far soever we pursue the minuteness of its parts, is still capable of repeated divisions, even to infinity; it is plain, that this absurdity will follow us, through all the suppositions that make thought inherent in a material substance. Finding, therefore, consciousness incompatible with the cohesion of solid separable parts, we are necessarily led to place it in some other substance, of a distinct nature and properties which we call spirit.

SECTION X.

Body and Spirit distinct Substances.

And here it is carefully to be observed, that the several species of *corporeal* substances, though distinguished one from another, and ranked under different names; yet, agreeing in some common properties, which, taken together, make up the notion of body, are thence all conceived to partake of this general nature, and to differ only as different modifications of the same substance. Whatever consists of solid extended parts, is called matter; and as all the various species of body, however distinguished from one another by their several properties, have yet this in common, that they are made up of such solid separable parts, hence they fall naturally under the general denomination of material beings, and are not conceived to differ, but in their form. Thus gold, antimony, wood, &c. alike partake of the notion of body; they are all equally material substances, and have no other difference, but what arises from the different structure and conformation, &c. of parts, as we have shown above. But *spirit* is something altogether distinct from body, nay, and commonly placed in opposition to it; for which reason, the beings of this class are called *immaterial*; a word that implies not any thing of their nature, but merely denotes its contrariety to that of matter.

SECTION XI.

There may be many various Species of Substances, besides those that come within the reach of our Faculties.

Body and spirit, therefore, differ not as species of the same substance, but are really distinct kinds of substances, and serve as general heads under which to rank all the particular beings that fall within the compass of our knowledge. For we having no ways of perception but sense and consciousness, can have no notices of things, but as derived from these two inlets. By our senses we are informed of the existence of solid extended substances ; and reflection tells us, that there are thinking conscious ones. Beyond these our conceptions reach not ; and therefore, though there may be many other kinds, as different from them as they are from one another, yet, having no faculties suited to them, they are as remote from our knowledge, as light and colours from the apprehension of a man born blind. I believe it will hardly be doubted but the substance of the Creator differs more from that of his creatures, than any two created substances can from one another ; and therefore, when we call God a spirit, we ought not rashly to presume, that he is so in the same sense in which the human soul is a spirit. The word is, indeed, used by us to denote, in general, all thinking intelligent substances, in which sense God is very fitly called a spirit. But it were the height of folly to imagine, because this name is applied as well to the mind of man as the Creator, that therefore they partake of one common nature, and differ only as different modifications of the same substance. This I mention here to check the presumption of the human mind, always forward to conclude, that every thing comes within its reach, and to deny existence to whatever exceeds the comprehension of its scanty and limited powers. Beings of a superior class may enjoy many ways of perfection unknown to us, from which they receive notices as different from those in our minds, as the ideas we apply to spirit are from the ideas we apply to body. Solid and thinking beings are, it is true, the only ideas of substance that we are able to frame; but this is no more an argument against the existence of other kinds, than the want of the ideas of light and colours in a blind man would be a good argument against the reality or possibility of such perceptions.

SECTION XII.

Difference in the Manner of conceiving Corporeal and Spiritual Substances.

Before I dismiss this subject it may not be improper to take notice of a remarkable difference as to the manner of our receiving corporeal and spiritual substances. Those of the first kind convey themselves into the mind by impressions made upon the organs of sense; and as these impressions are different in different bodies, the ideas they produce must of course vary in proportion. Thus we get perceptions of distinct powers and properties, and range bodies into classes, according as we find them to agree or disagree in their observable qualities. But it is not so in our notion of spirits; for having no conception of their powers and operations but by what we feel and experience within ourselves, we cannot ascribe to them properties or ways of knowledge distinct from those suggested to us by our own consciousness. And hence it is, that though we readily own there may be various ranks of spiritual beings, yet we are not to imagine them divided from one another by any diversity of powers and operations, but merely by possessing the same powers, &c. in a higher or lower degree. It is not, however, repugnant to reason, that they should be distinguished by their several properties in like manner as sensible things are by the different qualities observable in them; but properties of intellectual natures, distinct from those of our own minds, being altogether remote from our conception cannot serve as a means whereby to distinguish their different orders. We are therefore necessitated to conceive of them in a manner suited to our way of knowledge; and when we would rank them into species, according to the degrees of superiority they are imagined to possess in the scale of being, we ascribe to them what we find most excellent in ourselves, as knowledge, thinking, foresight, &c. and those in different measures proportioned to the station peculiar to each rank or species. But that this is a very imperfect way of distinguishing the various orders of intellectual beings, will not, I think, need many words to make it appear; especially if we consider, that the manner of communicating their thoughts, without the intervention of bodily organs, is a thing to us altogether incomprehensible, and necessarily leads us to suppose, that they have ways of perception and knowledge which our faculties cannot give us any notice of.

SECTION XIII.

The bounds of Knowledge in our present state very narrow.

But I shall not pursue these reflections farther; what has been said sufficing to give us some little insight into the extent and capacity of our own minds; to convince us that our present state will not admit of a perfect and adequate comprehension of things; and to let us see, that there may be other ways of knowledge, beyond the reach of the faculties we now enjoy; which yet, in succeeding stages of our existence, we may arrive at, when, being freed from the present cumbersome load of the body, we shall mount up to stations of greater eminence, and advance by a perpetual series of approaches towards him, who is the standard of perfection and happiness.

CHAP. IV.

OF IDEAS FRAMED BY THE MIND.

SECTION I.

In framing many complex Ideas, the Mind is wholly active, and proceeds by a voluntary choice.

HITHERTO we have considered only such combinations of our simple ideas as have a real union in nature, and are suggested to the mind by things themselves variously affecting our perception: it is now time to take a view of the other class of our complex notions; I mean those arbitrary collections of different ideas, which we on many occasions bring together by that power which we find in ourselves, of uniting, comparing, and diversifying our notices of things. In the reception of simple ideas, and even in those of substances, the understanding is wholly passive, and the perceptions produced correspond to the impressions made upon it. When we see a house or a tree, they necessarily appear each under its proper form; nor is it in our power to receive from these objects other ideas than what they are fitted to produce. But in this second class of complex conceptions, the mind acts voluntarily and of choice; it combines only such ideas as are supposed best to suit its present purpose; and alters or changes these combinations, by inserting some, and throwing out others, according as the circumstances of things require their being viewed in different lights. Now as this is by far the most comprehensive branch of our ideas, and includes those that most frequently occur in the search and pursuit of knowledge, I shall endeavour to treat them in the exactest order and method, and for that purpose range them under several heads, according to the different acts of the mind exerted in framing and putting them together.

SECTION II.

Three several Acts exerted by the mind in framing its arbitrary Ideas, viz. Composition ;

These acts may in the general all be reduced to three. 1. *Composition*,when we join many simple ideas together, and consider them as one picture or representation. Such are our ideas of beauty, gratitude, a furlong, &c. And here let it be observed, that the mind sometimes confines itself to the various consideration of the same idea, and, by enlarging it in different degrees, exhibits it under a diversity of forms. Thus by adding units together, in distinct separate collections, we come by the several combinations of numbers, as a dozen, a score, a million. At other times we unite perceptions of different kinds; in which case the composition is more manifest, and the idea itself becomes of course more complicated. Harmony, for instance, is a compound idea, made up of many different sounds united; all which the musician must have, and put together in his mind, before the ear can be entertained with the actual performance. Now although the act of the mind is in some measure exerted in the framing of all our complex notions, yet as many of them include certain limited and particular considerations, arising from other operations of the mind employed about them, it is necessary to take account of these acts also, if we would conceive clearly the manner in which the several species of our compound ideas are formed.

SECTION III.

Abstraction ;

2. The next operation therefore of the mind, about its ideas, is *abstraction*, when we separate from any of our conceptions all those circumstances that render it particular, or the representative of a single determinate object ; by which means, instead of standing for an indi-

vidual, it is made to denote a whole rank or class of things. Thus upon seeing, for instance, a square or circle, we leave out the consideration of their bulk, and every thing else peculiar to them, as they immediately affect our sight, retaining only the notion of their figure and shape. In this manner we get our *general* ideas; for such naked appearances, separated from the circumstances of time, place, &c. serve the mind as standards by which to rank and denominate particular objects. When therefore we meet with a figure answering to that shape and form we had laid up in our understandings, it is immediately referred by the mind to this pattern, and called by its name, which by this means becomes proper to the whole species. Thus a square, or circle, are *universal* terms, common to all figures of that particular shape, and alike applicable to them wherever they exist; in like manner as the ideas themselves are *general*, and representatives of all the kind.

SECTION IV.

And Comparison.

3. The third and last act of the mind about its ideas, is the *comparing* them one with another, when we carry our consideration of things beyond the objects themselves, and examine their respects and correspondences in reference to other things which the mind brings into view at the same time. It is thus we get all our ideas of *relations*, as of greater, less, older, younger, father, son, and innumerable others. This threefold view of our ideas, as either compounded of many others put together, or made universal by the abstraction of the mind, or as representing the various relations and habitudes of things, will give us an opportunity of observing whatever is most curious and useful in this fundamental branch of knowledge, and of explaining the manner and procedure of the understanding in enlarging its views, and multiplying the objects of perception. That we may therefore conceive of this matter with the greater order

and clearness, we shall make each of these several ideas the subject of a distinct article.

ART. I.

OF COMPOUND IDEAS.

SECTION I.

Compound Ideas considered here merely as Combinations of the Understanding.

We begin therefore with those ideas which may be properly termed *compound*, as being derived from that power the mind has of uniting many conceptions into one. Though this class comprehends, in some sort, all our complex notions, yet they are at present considered merely as they are combinations of the understanding, and with a view to those particular ideas out of which they are framed. Here, as was already observed, the mind sometimes proceeds by enlarging and diversifying the same idea; at other times it brings together ideas of different kinds; and in both ways finds infinite scope and variety. But that we may follow the natural procedure of the intellect, and trace it in its advances from simple to more complicated acts, we shall first take a view of it as employed about one and the same idea, where perhaps we may meet with such instances of address, management and contrivance, as will appear perfectly astonishing to one who has never set himself seriously to consider the manner and conduct of his own mind.

SECTION II.

Unity the Original and Foundation of all our Ideas of Number.

The most obvious and simple idea we have, is that of unity or one. By adding it to itself continually, and retaining the several collections in our minds, we come by all the different combinations of numbers, in which we readily perceive an endless diversity. All these ideas are nevertheless evidently distinct among themselves, the addition of a single unit constituting a number as clearly different from that immediately before it, as any two the most remote ideas are from one another. But that the understanding may not lose itself in the consideration of those infinite combinations of which unity is capable, it proceeds by regular steps; and beginning with the original idea itself, pursues it through all its varieties, as they are formed by the repeated continual addition of unit after unit. Thus numbers are made to follow one another in an orderly progression, and the several successive collections are distinguished by particular names.

SECTION III.

The artful composition of the names of Numbers a great help to our conceptions;

And here we may take notice of a wonderful artifice made use of by the mind, to facilitate and help it forward in its conceptions. For as the advance from number to number is endless, were they all to be distinguished by different denominations that had no connexion or dependence one upon another, the multitude of them must soon overcharge the memory, and render it impossible for us to go any great way in the progress of numbering. For this reason it is so contrived, that the change of names is restrained to a few of the first combinations, all the rest that follow being marked by a repetition of the same terms, variously compounded and linked together. Thus thirteen is ten and three, fourteen, ten and four, and so on to twenty, or two tens, when we begin again with one, two, &c. until we advance to thirty, or three tens. In this manner the progression continues; and when we arrive at ten tens, to prevent confusion by a too frequent repetition of the same word, that sum is distinguished by the name of a hundred. Again, ten hundred is called a thousand, at which period the computation begins anew, running through all the former combinations, as ten thousand, a hundred thousand, ten hundred thousand; which last collection, for the reasons mentioned above, has the name of a million appropriated to it. With this million we can begin as before, until it is repeated a million of times; when, if we change the denomination to billions, and advance in the same manner through trillions, quartillians, the series may be carried on without confusion, to any length we please.

SECTION IV.

And of the principal Reasons that our Ideas of Numbers are so remarkably distinct.

This artful combination of names to mark the gradual increase of numbers, is perhaps one of the greatest refinements of the human understanding, and particularly deserves our admiration for the manner of the composition; the several denominations being so contrived as to distinguish exactly the stages of the progression, and point out the distance from the beginning of the series. By this means it happens, that our ideas of numbers are of all others the most accurate and distinct; nor does the multitude of units assembled together, in the least puzzle or confound the understanding. It is indeed amazing, that the mind of man, so limited and narrow in its views, should yet here seem to shake off its natural weakness, and discover a capacity for managing with ease the most bulky and formidable collections. If we inquire particularly into the reason of this, we shall find it wholly owing to the address of the mind in thus distinguishing numbers by different names, according to the natural order of progression. For as those names are made to grow one out of another, they may be aptly compared to a chain, all whose parts are linked together by an obvious and visible connexion. Hence it comes to pass, that when we fix our thoughts upon any number, however great and seemingly unmanageable, yet, if it is once determined to a particular name, we find it easy to run back through all the stages of the progression, even till we arrive at unity itself. By this means we see, with a single glance of our minds, not only the two extremes of the number under consideration, but also the several intermediate parts, as they are united to make up the whole.

SECTION V.

As they help us to a clear perception of the interjacent Parts.

Now it is to this clear and accurate view of the interjacent ideas, that we owe our so distinct perception of the various combinations of numbers. And indeed we may observe, in the general, that all our ideas of quantity, especially when they grow to be very large, are no otherwise ascertained than by that perception we have of the intervening parts, if I may so say, between the extremes. When we look at any object considerably distant from us, if we have a clear view of the interjacent lands and houses, we are able to determine pretty nearly of its remoteness; but if, without such a knowledge of the intervening spaces, we should pretend to judge of the distance of objects, as when we see the spire of a steeple behind a wall, or beyond a mountain, every one's experience is a proof how liable we are, in these cases, to be deceived. Just so it is in judging of duration. When we carry back our thoughts to any past period of our lives, without consideration of the number of years or months, we find that our idea of the time elapsed grows more distinct, in proportion as we become sensible of the intermediate parts of our existence. At first we are apt to judge the distance extremely short; but when we set ourselves to consider our several successive thoughts and actions, the idea of the duration grows upon us, and continues to increase as the attention of the mind brings new periods of life into view.

SECTION VI.

Without names, we cannot make any progress in Numbering.

Hence it will be easy to conceive how much the mind is helped forward in its perception of number, by that ready comprehension of all the several stages in a progression which peculiarly belongs to ideas of this class. But this, as I have before intimated, we derive from the orderly series and connection of names, insomuch that where they cease, the computation of numbers also ceases with them. We can have no idea of any sum, without a knowledge of all the terms that go before, according to the natural order in which they follow one another; so that he who cannot, in a regular way, count to ninety-nine, will never, while that incapacity continues, be able to form the idea of a hundred; because the chain that holds the parts together is to him wholly unserviceable, nor can he represent to his mind the several interjacent combinations, without which it is impossible in this case to arrive at a distinct perception.

SECTION VII.

The great advantages of Address in classing our complex Conceptions.

I have insisted the more largely upon this, not only because it is by number that we measure all other things, as duration, extension, motion, &c. but also because it lets us into the most natural view of the conduct and procedure of the understanding, and makes us sensible of the great art and address that is necessary in the classing our very complex conceptions. He that can so put together the component parts of an idea, as that they shall lie obvious to the notice of the mind, and present themselves, when occasion requires, in a just and orderly connexion, will not find it very difficult to obtain clear and accurate perceptions, in most of those subjects about which our thoughts are conversant. For the great art of knowledge lies in managing with skill the capacity of the intellect, and contriving such helps as, if they strengthen not its natural powers, may yet expose them to no unnecessary fatigue ; by entangling and perplexing them with considerations remote from the business in hand. When ideas become very complex, and by the multiplicity of their parts grow too unwieldly to be dealt with in the lump, we must ease the view of the mind, by taking them to pieces, and setting before it the several portions separately one after another. By this leisurely survey we are enabled to take in the whole ; and if we can draw it into such an orderly combination, as will naturally lead the attention, step by step, in any succeeding consideration of the same idea, we shall ever have it at command, and with a single glance of thought be able to run over all its parts. I have therefore explained here, at some length, the conduct of the mind in numbering ; it seeming to me the best model in this kind, whether we consider the many advantages derived from such an orderly disposition of our ideas, or the great art and skill displayed in binding these ideas together. This also is farther remarkable, in the consideration of number, that from it chiefly we derive the notion we have of infinity ; it being apparent that, in adding number to number, there is no end ; the possibility of doubling or increasing our stock in any degree, remaining as obvious to the understanding, after a great and continued run of progressions, as when it first began the computation.

SECTION VIII.

The Consideration of Number, of great Use, in ascertaining our Ideas of Space and Duration.

If we now turn our thoughts towards space and duration, here too we shall find that we very seldom arrive at clear and distinct ideas of either, but when we introduce the consideration of number. The more obvious and limited portions, it is true, easily slide into the mind the natural way of perception; but it was the necessity of comparing these together, that put us upon the contrivance of certain stated measures by which precisely to determine the quantity in each. Thus, inches, feet, yards, miles, &c. ascertain our ideas of extension; as minutes, hours, days, years, &c. measure the progress of duration. The lesser parts, as lying most open to the notice of the understanding, and being more on a level with its powers, are retained with tolerable exactness; and the larger portions, when the number of repetitions of which they are made up is known, are thereby also reduced into clear and determinate conceptions. A foot and yard are measures easily comprehended by the mind; nor do we find any difficulty in conceiving a mile, when we consider it as equal to a certain number of yards. If we are still for increasing the standard, we may take the semi-diameter of the earth, and supposing it equal to eight thousand miles, make use of it as a measure by which to ascertain the distance of the sun or fixed stars. Just so it is in duration; from hours we rise to days, months, and years; by these, repeated, and added together, we measure time past, or can run forward at pleasure into futurity, and that without any confusion or perplexity.

SECTION IX.

Without they are apt to degenerate into a confused and irregular Heap.

It is however to number alone that we owe this distinctness of perception, inasmuch as space and time, considered apart from the regular and orderly repetition of miles or years, leave no determinate impressions in the mind, by which to know and distinguish their several portions. Ideas of either, thus taken in at a venture, are a confused and irregular heap, especially where we endeavour to enlarge and magnify our views, and give full play to the powers of our intellect. Something, indeed, the mind conceives, vast and mighty, but nothing that is precise, accurate and just. But when it begins to consider these ideas as made up of parts, and fixing upon such as are proportioned to its reach, sets itself to examine how often they are repeated to make up the whole, the perceptions of the understanding put on a new form, and discover their exact bounds and limits.

SECTION X.

Infinity an Object too mighty for the Survey of the Human Mind.

And thus, as before in number, so here in extension and duration, the mind begins with simple and obvious notices, advancing by degrees to more enlarged and intricate conceptions. A day, or a furlong, are of easy apprehension to the understanding, and by their subdivisions into still lesser spaces, exhibit themselves distinctly in all their parts. With these variously repeated, we travel through space and time; so that being able to reduce all our ideas of this class, however mighty and enlarged, to the clear and determinate perceptions of number, we can conduct our thoughts without perplexity, and never find ourselves puzzled, but when, presuming too much on our own strength, we launch into speculations, that stretch beyond the powers of the human intellect. Number may be compared to a line, that, setting out from unity, runs on in a continued increase of length, without a possibility of ever arriving at its ultimate period. So far as we pursue it in our thoughts, and trace its regular advances, so far our ideas are accurate and just. But when we let loose our understandings after a boundless remainder, and would fathom the depth of infinity, we find ourselves lost amidst the greatness of our own conceptions. Some notions, it is true, we have, but such as, exceeding the dimensions of the mind, lie involved in darkness and obscurity; and being destitute of order, method, and connexion, afford no foundation whereon to build any just and accurate conclusion.

SECTION XI.

Never represented in its full Dimensions, but by an endless and ever growing Idea.

And this perhaps may be the reason why many modern philosophers, in their discourses concerning infinity, have run into apparent contradictions; because, encountering an object too large for the survey of the understanding, they found themselves surrounded with inextricable difficulties, which their scanty and defective ideas were by no means able to dissipate or remove. The truth of it is, finite ideas alone are proportioned to a finite understanding; and although we are not wholly without a notion of the infinity of number, yet it is not such a one as comprehends and exhausts its object, or exhibits it to the mind in its full size and dimensions. We only see the idea as capable of an endless increase, but cannot by any effort of thought take in the whole prospect; and indeed it is properly that part of it which lies beyond the reach of our perception, and still remains to be taken into the account, to which we give the name of infinity.

SECTION XII.

Duration, whether considered as past or to come, Boundless, whence our Idea of Eternity.

This idea of the infinity of number, imperfect as it may seem, is nevertheless that by which the mind ascends to the conception of *eternity* and *immensity*. For when we consider duration, either as past or to come, we find nothing to stop the progress of our thoughts, in the repetition of years, or millions of years: the farther we proceed, the more the idea grows upon us: and when we have wearied ourselves with vain efforts, we must own at last that we can no more arrive at the end of duration than at the end of number. It is true, the several generations of men arise and disappear in very quick successions; earth itself may decay; and those bright luminaries that adorn the firmament of heaven be extinguished. But the course of time will not be thereby disturbed; that flows uniform and invariable, nor is bounded by the period of their existence. This double view of duration, as having already revolved through numberless ages, and yet still advancing into futurity in an endless progression, properly constitutes our ideas of *eternity*. We speak indeed of an eternity past, an eternity to come, but both these are bounded at one extreme: the former terminates in the present moment, and therefore has an end: the latter sets out from the same period, and therefore has a beginning; but, taken together, they form a line both ways infinitely extended, and which represents eternity in its full dimensions.

SECTION XIII.

The Idea of Immensity derived from the Consideration of Space ever growing on all sides of us.

As, in the consideration of time, we fix upon the present moment, regarding it as the middle point which divides the whole line of duration into two equal parts: so, in the consideration of space, that particular place in which we exist is looked upon as a kind of centre to the whole expansion. From thence we let loose our thoughts on every side—above, below, around—and find we can travel on, in the repetition of miles, and millions of miles, without ever arriving at the end of the progression. It is not difficult, indeed, to carry our conceptions to the utmost bounds of the universe; at least so far as it falls within our notice. But then the imagination rests not here; it sees immeasurable spaces beyond capable of receiving new worlds, which it can pursue, as rising one above another in endless succession. This consideration of space ever growing on all sides of us, and yet never to be exhausted, is that which gives us the idea of *immensity;* which is in fact nothing else but the infinity of number, applied to certain portions of extension, as miles, or leagues, &c. and these conceived as extended every way around us, in infinite and innumerable right lines.

SECTION XIV.

Compound Ideas resulting from the Union of Perceptions of different Kinds.

Hitherto we have considered the mind as employed about one and the same idea, enlarging and diversifying it in various forms. We have seen it rising from the most simple and obvious notices to the conception of infinity itself; and taken a view of it in all the different stages of its improvement. Let us now proceed to the more complicated act of composition, when the mind brings several ideas of different kinds together, and voluntarily combines them into one complex conception. Such, for instance, is our idea of a *tune*, as comprehending a variety of notes, with many different modulations of sound. And here it is to be observed, that though the complex idea may be excited in us, by hearing the air itself struck off upon a proper instrument; yet, considered originally, it still belongs to this class of perceptions, which are distinguished as the arbitrary collections of the mind. It was the musician, or composer, that combined the several notes, and determined the order in which they were to follow one another; nor had that peculiar composition of sounds any real union in nature, before they were thus brought together in his mind. Of the same nature are most of our ideas of human actions; for though many of them come to our notice by seeing the actions themselves, or hearing them described by others, as *distilling*, *carving*, *treason*, &c. yet it is plain that they must have been projected and contrived in the mind of man before they had a real existence.

SECTION XV.

How the Mind is determined in making these Combinations.

It is here that the understanding has the greatest scope, and finds most employment for its active powers: nor indeed is it possible to set any bounds to the ideas of this class; the combinations already made being almost innumerable, and those yet in the power of the mind affording an endless diversity. It may not, however, be amiss to consider how we conduct ourselves amidst so great a variety, and by what rules we proceed in making those combinations to which we have affixed particular names, while others, perhaps, no less obvious, are neglected. The idea of killing, for instance, joined to that of a father, makes a distinct species of action, known by the name of *parricide*. It was doubtless as obvious to distinguish between the killing of an old man and a child, which yet we find is not done, both these actions being comprehended under the general name of *murder*. By what views therefore does the mind regulate its combinations? Why is it determined to one collection of ideas rather than another? This cannot be well understood, without observing, that it is the end of language to communicate our thoughts one to another. Words are the signs of our ideas, and serve to express the conceptions of the mind. Now it is apparent, that such conceptions as are most apt to occur in the commerce of life, would be first distinguished by particular names; the frequent occasion men have of mentioning these among themselves, rendering this absolutely necessary. But as many of these conceptions are collections of different simple ideas, hence we are insensibly led to such peculiar combinations, as are most serviceable to purposes of mutual intercourse and communication.

SECTION XVI.

Ideas of Human Actions often formed before the Actions themselves exist.

Let us suppose, in the first beginnings of society, a company of legislators met together, in order to consult on proper regulations for the government of the community. If they are men of prudence and foresight, they will naturally observe many new occurrences, likely to arise from this coalition of mankind, and their living together in crowds. Perhaps the age in which they live, has not produced an instance of one man's killing another; yet from the knowledge of their own frame, and their power of doing hurt, they conceive this as a possible case, and are willing to provide against it. Thus all the ideas that enter into the complex one of murder, are brought together, and united into one conception, before the action itself really exists. It is not, however, thought necessary to take into consideration the age of the person; the chief thing in view being to prevent the putting an end to another's life unjustly, whether old or young; and therefore the penalty equally affects both cases. But when they come to consider the relation in which the person killed may stand to the murderer, here there appears a manifest difference; as it adds to the crime, when committed upon a benefactor, and renders it particularly heinous in the case of a father. This last, therefore, is made to constitute a distinct species of action, and has a peculiar punishment allotted to it. Thus we see how men, according to their different manner of life, and the relations they stand in to one another, are naturally led to form several collections of simple ideas, preferably to others, as foreseeing they may have frequent occasion to take notice of such precise combinations. And because it would be tedious in conversation, every time these complex notions occur, to enumerate all the ideas of which they consist; therefore, for the sake of ease and dispatch, they give them particular names, and thereby render the compositions fixed and permanent.

SECTION XVII.

The Necessity of Mutual Intercourse and Men's particular Aims in Life, a great source of Complex Ideas.

That it is in this manner we come by our complex ideas, which multiply upon us according as the exigencies of society require, or our pursuits, method of life, and different aims, throw occasions in our way, of combining such and such perceptions together, might be easily made to appear, by a short view of the combinations themselves. Human actions, as occurring most frequently, and affording large matter of conversation, debate, and inquiry among men, have been very nicely modified, and distinguished into classes, according to the several circumstances most likely to attend them. In like manner, the arts and sciences, in proportion as they are cultivated, leading us into many compound views of things, which otherwise would never offer themselves to the consideration of the mind; the complex ideas of this sort, with the names by which they are expressed, are, we find, the work of such particular nations, where these arts and sciences have chiefly flourished. The Greeks, for instance, excelled in learning and polite knowledge; hence many of the terms belonging to rhetoric, poetry, philosophy, physic, &c. come originally from their language. Modern fortification has received its greatest improvements among the French; and accordingly the ideas and terms of the art are mostly derived from writers of that nation. In Italy, architecture, music, and painting, have been the great exercise of the men of genius; it is therefore among them that we find the several complex notions belonging to these parts of study, as well as the names by which they are expressed; nor can we discourse accurately and minutely of the above mentioned arts, without having recourse to the language of that climate. And if we descend into the particular callings and professions of men, they have all their peculiar collections of ideas distinguished by their several names, and hardly known but to such as are conversant in that manner of life. Thus calcination, cohobation, filtration, &c. are words standing for complex ideas frequently framed in the minds of chemists, and therefore familiar to men of that employment. Yet as these, and such like combinations, seldom occur in common life, the generality of mankind, we see, are in a great measure unacquainted with them.

SECTION XVIII.

Hence different Sets of them prevail in different Countries: and Words in one Language have none to answer them in another.

I might pursue these speculations farther, and show how the several fashions, customs, and manners of one nation, leading them to form many complex notions which come not so naturally in the way of another; different sets of ideas prevail in different countries, and of course have names appropriated to them in the language, to which there are no words that answer in another. The procedure and forms of our courts of justice have introduced many terms into the English law, which stand for collections of ideas framed among no other people. Nor would it be possible to render these terms by any single words of another language; because, where ideas themselves prevail not, there are no names provided to express them. In this case, therefore, it becomes necessary to use circumlocutions, and enumerate the several ideas comprehended in the collection, if we would so express ourselves, as to be understood in the language of other nations. Nay, even among the same people, the change of customs and opinions frequently brings new sets of ideas, which, of course, must be distinguished by particular names; while at the same time, the notions of former ages grow into disuse, and the words answering them are wholly laid aside, or employed in a signification different from what they had before.

SECTION XIX.

This, too, the cause that Languages are in a perpetual flux.

Thus languages are in a perpetual flux, and by degrees vary so much from their original frame, as to become unintelligible even to the descendants of those who speak them. If we run back into the ages of chivalry in England, when tilts and tournaments were in fashion, how many complex ideas, peculiar to that mode of life, shall we find familiar among the men of those times, which are now little known or attended to? On the contrary, the improvements in arts and sciences that have since taken place, have led us into innumerable views of things, to which our forefathers were perfect strangers. But I shall not push these reflections any farther, believing that what has been said will be sufficient to show the origin and progress of our compound ideas, and how the mind is directed in the choice of the combinations it makes. We therefore proceed to the consideration of abstract ideas, which make the subject of the following article.

ART. II.

OF ABSTRACT OR UNIVERSAL IDEAS.

SECTION I.

General Ideas formed by the Abstraction of the Mind.

Having dispatched what was necessary to be said concerning our compound ideas, considered merely as they are combinations of the understanding, it is now time to explain how we come by our general notions, which serve to represent to us a multitude of individuals, and are the standards by which we rank things into sorts. And this, as we have before intimated, is done by the abstraction of the mind; which act may be extended to all our ideas, whether simple, compound, or of substances. If, for instance, we fix our attention on any particular colour, as scarlet, we can leave out the consideration of all present circumstances, as the subject in which it inheres, the time and place of seeing it, &c. and retaining only the impression itself, make it a representative of that quality or appearance, wherever we chance to meet with it. It is thus that abstract and universal ideas are framed; for the mind regarding only the scarlet colour, which one day it observes perhaps in a piece of cloth, another in a picture, and a third in the rainbow; the appearance is conceived to be the same in all these objects, and therefore is called by the same name.

SECTION II.

All the Perceptions of the Understanding particular.

But to enter a little more closely into this matter, and show that these our general conceptions are the mere creatures of the understanding, it may not be amiss to take notice, that all our perceptions of things, whether we derive them from sensation or reflection, are of their own nature particular, and represent to us single determinate objects. When we see a horse, for instance, in the fields, our idea is that of an individual. If we hear a sound, it is something particular, and different from what we hear at any other time. Every perception of the mind is distinct from every other perception; nay, and every idea brought into view by the imagination, as when we frame the image of a lion standing before us, is still singular, and represents a single object.

SECTION III.

The Idea of the Species represents what is common to different individuals.

But when we come to take a view of these several particulars, we readily observe among some of them a resemblance ; and framing to ourselves an idea of those things in which any of them are found to agree, we thereby get a general notion, applicable to many individuals. Thus horses are found to resemble one another in shape, voice, and structure of parts. The idea, which takes in only the particulars of this resemblance, excluding what is peculiar to each single animal, becomes of course common to all creatures of that kind, and is therefore the representative of a whole class of beings. Accordingly the name of that general idea is given to every animal in which that shape, voice, and structure is found ; for the word horse, implying only these particulars, must belong to all creatures wherein they exist. This is the first step or gradation in the forming of abstract notions, when the mind confines itself to the consideration of individuals, and frames an idea that comprehends such only under it. The rank or class of things answering to this idea, is called species in the language of the schools. So a horse is a certain species of animals, an oak is a species of trees, and a square is a species of four-sided figures.

SECTION IV.

The idea of the Genus represents what is common to several Species.

When we have thus learned to rank individuals into sorts and classes, according to the resemblance found among them, the mind proceeds next to consider the species themselves, and often in these too, observes a certain likeness. Whereupon, throwing out all those particulars wherein the several species are found to disagree, and retaining only such as are common to them all, we thereby frame a still more general idea, comprehending under it a variety of different species. Thus a sparrow, a hawk, an eagle, &c. are distinct species of birds, which have each their peculiar shape and make. They nevertheless resemble one another, in being covered with feathers, and provided with wings that bear them through the air. Out of these particulars we form a new idea, including all the common properties of the feathered kind; and appropriating to it the name of *bird*, mark by that word another class of things, of a higher order than any of the former. This superior division, which extends to several species at once, is called in the schools the *genus*, and is the second step the mind takes in advancing to universal notions.

SECTION V.

The Mind may advance by manifold Gradations, in rising from Particulars to Generals.

And thus have I given a short, but I hope intelligible account, of the business of *genera* and *species*, about which so much has been said in the writings of logicians. *Species*, in strictness and propriety of speech, is such a rank or class of things, as comprehends under it only individuals: *genus* advances still higher, and takes in a variety of distinct species. It is, however, to be observed that the mind, in rising from particulars to generals, does not confine itself to one or two gradations, but may carry its views through the whole extent of things, until at length it arrive at an idea embracing the universal compass of nature. For when we have ranked things into sorts, and reduced these again to the higher order or *genus*, these *genera* are still found to resemble one another in some particulars, which being collected into one idea, form a new and more comprehensive division of things. Thus *bird* is a *genus*, embracing all the varieties of the feathered kind. *Fish* implies the several species of living creatures which inhabit the waters. *Quadruped* and *insect* are also universal ideas, that take in many inferior distributions and classes. Yet all these different orders of being have this in common, that they are provided with organical bodies, fitted for the purposes of life and spontaneous motion. An idea, therefore, comprehending only these last particulars, will equally belong to all the divisions before enumerated; and the word *animal*, by which it is expressed, becomes a general name for the several creatures endued with life, sense, and spontaneous motion. If we are for carrying our views still farther, and framing a yet more universal notion, we can cast our eyes upon both the animate and inanimate parts of nature; wherein we find this mutual correspondence, that they exist, and continue in being. This last idea, therefore, of *being*, in general, comprehends under it all the varieties of things, and may be universally applied to whatever has life or existence; so that in respect of the present frame of nature, it is the highest and most universal idea we have.

SECTION VI.

Whence many intermediate Steps between the highest Genus and lowest Species.

In this series of notions, rising one above another, in the degree of universality, that division, which comprehends under its several genera, is called in the schools the *higher genus;* which denomination continues, until we arrive at the last advance of the understanding, when being come to the most general of all ideas, that admits not of a superior, it is distinguished by the name of *genus generalissimum*. In like manner the several *genera*, comprehended under a higher *genus*, are, in respect of it, considered as *species;* and as these two last have species under them, the inferior divisions are, for distinction's sake, termed *lower species*. Thus the progression continues, and when we come to the lowest subdivision of all, comprehending only individuals, which, as I have before intimated, constitutes the proper species, this the schools denominate the *species specialissima*. All that lie between it and the highest distribution of things, are the intermediate genera and species, which are termed each in their turn, *genus generalius*, or *species specialiar*, according as we consider them in the ascending or descending scale of our ideas; or, to speak in the language of logicians, according to their ascent or descent, *in linea prædicamentali.* I should not have entered so far into these verbal disquisitions, had not the terms here explained been such as frequently occur in the writings of philosophers; insomuch, that without some knowledge of them, we must often be at a loss, in the prosecution of these studies. Besides, it is both curious and useful to see the gradual progress of the mind, in its advances from particular to general conceptions—to observe it ranging its ideas into classes, and establishing a just and regular subordination in its views and notices of things. This is the shortest way to knowledge, and affords the best means of preserving the order and due connexion of our thoughts, so as to make them subservient to the increase of science. For when we see how things comprehend, or are comprehended in, one another, we are able to discover the mutual dependence of all the several branches of knowledge which leads us into the true and natural method of conducting our understandings in the search of truth.

SECTION VII.

General Ideas the Creatures of the Understanding.

From what has been said, it is evident that general ideas are the creatures and inventions of the understanding. Nature, it is true, in the production of things, makes many of them alike: but it is the mind alone that collects the particulars in which they agree, into one idea, and sets it up as a representative of many individuals. And now I think we may venture upon that much agitated question, where do the genera and species of things exist? To which I answer, in the mind. *Universality* belongs not to things themselves, it being apparent, that they are all particular in their existence. However, as they often have many properties in common, the understanding, by uniting these into one conception, obtains a general idea under which it ranks all the several objects wherein these properties are found. So far indeed we must allow that the particular combination of properties, which constitutes the genus or species, exists in all the individuals referred to that genus or species; but then it is in conjunction with other properties, by which these individuals are distinguished from one another. Thus the collection of simple ideas, signified by the word *bird*, is to be found, for instance, in a *hawk*, or any other single animal, to which we apply that general name; but the notion itself, abstracted from all the particulars to which it belongs, has evidently no existence out of the understanding. There is not a being in nature that can be called a *bird* in general, or that does not necessarily imply, in the very conception of it, several simple ideas, besides those marked by that word. For the name, in this case, signifies no more than an animal covered with feathers, and provided with wings, without regard either to shape, bulk, or the particular time and place of its existence. These last considerations, however, are inseparable from the reality of things, and therefore must be added to the general idea, before we can conceive any thing conformable to it actually brought into being.

SECTION VIII.

Considered apart, they exist only in the Mind, but in conjunction with other Ideas in the individuals comprehended under them.

Hence we see at once, what sort of an existence general natures have. Considered apart, and by themselves, they are wholly the workmanship of the understanding, and derive their being and reality from it; but viewed in conjunction with other ideas that co-exist with them in the several objects of nature, they are to be found in the individuals to which they refer; and therefore, according to this way of conception, may be said to have an existence in them. Thus, so long as the ideas answering to the words *man* or *tree*, continue general and undetermined, they have no real objects answering them in nature; nor can the collections of simple ideas marked by these names, while all others are supposed excluded, exist any where out of the understanding. Nevertheless, as all the simple ideas, included in the general notion of *man*, are to be found in every particular *man*, and all those implied in the notion of a *tree*, in every particular *tree*; hence the general nature of *man*, exists in every individual *man*, as does the general nature of a *tree*, in every individual *tree*.

SECTION IX.

Difference of Ideas considered as compound and as universal.

One thing still remains to be observed, with regard to these our general ideas; that, though many of them are evidently combinations of different simple ideas, and according to that way of considering them, are included in the first division of our complex conceptions, those, namely, framed by the composition of the mind; yet we are carefully to distinguish between an idea, as it is compound, and as it is universal. In the first case, the mind chiefly considers the several ideas thot are combined together; or, in other words, all the attributes, qualities or parts, that are contained in any idea. Thus the idea of a *bird*, includes life, sense, spontaneous motion, a covering of feathers, wings, &c. none of which can be left out without destroying the very nature of the idea, and making it something quite different from what it was before. This way of considering things, according to the number of their parts and properties, is called by logicians the *comprehension* of an idea. But the *universality* of our notions implies quite another turn of thinking, in as much as it fixes the regard of the mind upon the subject to which our ideas extend, or the individuals and species comprehended under them. In this sense, the idea answering to the word *bird*, takes in the several species of the feathered creation, the *hawk*, the *eagle*, *sparrow*, *lark*, and innumerable others, to all which it may, with equal propriety, be applied. And here it is remarkable, that the idea loses nothing of its force or *comprehension*, by being restricted to a particular kind. When I say the *bird of Jove*, though in this case the idea is restrained to the *eagle* alone, it still remains as distinct, and includes as many simple ideas in its composition, as when, before, it was extended to all the different tribes of feathered animals.

SECTION X.

The comprehension and extension of our Ideas.

We see, therefore, that our compound ideas may continue the same in respect to their attributes, or the number of parts, and yet vary considerably in the degree of universality. The general idea of *man* is the same, whether applied to the whole human race, or those of any particular nation. When I affirm, for instance, of mankind in general, that their knowledge falls short of perfection, and afterwards make the like observation of the men of the present age ; in both cases, the word *man* stands for one and the same collection of simple ideas ; but in respect of the individuals to which it is applied, there is a great and manifest difference. That is, the term *man*, denotes one invariable compound idea ; which, notwithstanding, considered as a general notion, may be contracted or enlarged at pleasure. And as in the former case, the several parts of the compound idea are called its *comprehension ;* so in the latter, the individuals, to which the universal idea is applied, are called its *extension.* I might add many more observations on this subject, but choose rather to stop here, having said enough to explain the difference between compound and abstract ideas, and show the reason of my ranging them under distinct heads.

ART. III.

OF OUR IDEAS OF RELATIONS.

SECTION I.

Ideas of Relations exceeding numerous.

I COME now to the third and last division of those ideas, which I consider as the creatures and workmanship of the understanding; such, namely, as arise from the comparing of things one with another. For the mind, in its view, is not tied to single objects; but can examine their references and respects, in regard to others, brought under consideration at the same time. And when it does so, and thence derives new notices of things, the ideas thus got are called relations, and make, I am apt to think, the largest class of all our perceptions. For every single object will admit of almost innumerable comparisons with others, and in this sense may become a very plentiful source of ideas to the understanding. Thus, if we compare one thing with another, in respect of *bulk*, we get the ideas of *greater*, *less*, or *equality*; if in respect of time, of *older* and *younger*; and so for other relations, which we can pursue at pleasure, almost without end; whence it is easy to conceive, how very extensive this tribe of our perceptions must be.

SECTION II.

Men chiefly determined to particular Comparisons by the Wants and Exigencies of Life.

I shall not pretend to trace out these ideas particularly, nor indeed so much as to enumerate their several divisions; it being enough to observe, that here, as well as in the other kinds of our complex ideas, we bound ourselves, for the most part, to such comparisons, as the exigencies of society, the wants of life, and the different professions of men, render necessary; and are more or less accurate in tracing out the relations of things, according to the degree of importance they appear to have in these respects. The relations of men one to another, arising either from the ties of blood, their several ranks and places in the community, or a mutual intercourse of good offices, being of great weight and concern in the commerce of life, have in a particular manner engaged our attention, and are therefore very minutely described. For the same reason, men have found it necessary, to determine as exactly as possible, the various dependence of things, as their happiness is nearly connected with this knowledge. When we consider objects merely in respect of existence, as either giving or receiving it, we come by the ideas of cause and effect: nor need I mention how much the welfare of mankind depends on an extensive view of things, as they stand connected in this relation; it being evident, that the several schemes and purposes of life, are all conducted upon a previous supposition, that certain known causes will have their usual regular effects, and such and such actions be attended with such and such consequences.

SECTION III.

Relations of Creator and Creature, &c.

But there are other relations of this kind, besides those that regard merely existence;. as when we also take into the account the additional gifts of a capacity for happiness, and the means of attaining it; which constitutes the relation of *Creator* and *creature*, in the more solemn acceptation of these words. Again, when we consider the great author of our being, not only as the Creator of the universe, but also as preserving and holding it together, and presiding over the present frame of things with uncontrouled dominion; he then appears under the notion of a *moral Governor*, to whom we are accountable for our actions, and the use we make of those powers and faculties we derive from him. Now, as it is of the highest consequence for men not to be unacquainted with these, and such like relations; hence we find, that the wisest nations, and such as best understood the true application of the powers of the mind, have always made it their chief study to regulate and ascertain these ideas, and trace them in all their consequences. And thus we may, in some measure, perceive how the mind proceeds in comparing its ideas together, and by what views it is chiefly governed, in framing the complex notions of this class, by which it represents the various habitudes of things, I shall only add upon this subject, these two observations.

SECTION IV.

Our Ideas of Relations very clear and distinct.

First, that our ideas of relations are, for the most part, very clear and distinct. For the comparing of things together, being a voluntary act of the mind, we cannot but suppose that it must be acquainted with its own views in the comparison; and of course have a clear conception of the foundation of that relation it sets itself to inquire into. Thus the relation of cause and effect, implying only that one thing produces, or is produced by another, which notions are always distinctly settled in the understanding before it goes about to make the comparison; it is evident that the idea representing this mutual respect of objects will be no less clear, than are the notions themselves upon which the relation is founded. And what is still more remarkable of the ideas of this class, they cease not to be distinct, even where the subjects compared are but very imperfectly known. For I can well enough conceive, that one thing has produced another, and that therefore they stand related as cause and effect, though my ideas of the things themselves may perhaps be very obscure, and come far short of representing their real nature and properties. I doubt not but it will be readily owned, that our idea of the universe, considered as comprehending the whole frame of created things, is very inadequate; and I think it is still more apparent, that our notion of the Supreme Being comes not up to the excellence and perfection of his nature. Yet we very well understand what is meant by calling God the author of the world; and though we comprehend not the manner of his producing it, find no difficulty in framing the ideas, the relative words *Creator* and *creature* stand for.

SECTION V.

Ideas of Relations among the most important Conceptions of the Mind.

I have yet another observation to make upon this subject; and it is, that our ideas of relations are among the most important conceptions of the understanding, and afford the largest field for the exercise and improvement of human knowledge. Most of our inquiries regard relative ideas, and are set on foot with a view to investigate the mutual habitudes of things. The mathematician has taken quantity for his province, and teaches us how to compare magnitudes of different figures and dimensions, in order to judge with certainty of their relative properties. The philosopher attaches himself to the chain of causes and effects, and endeavours to trace out the various dependence of things considered in this light. In fine, whither do all our researches tend, but by means of certain known properties and relations, to find out others that stands somehow connected with them? As for the importance of these conceptions no one can call that in question, who reflects, that from our relations to our Creator and one another, arise all the duties of morality and religion, and that the correspondence of the several objects of nature, to the organs of the body, and faculties of the mind, is that by which alone we can judge of what will procure us happiness or misery. Whence it is evident, that without an exact knowledge of these relations, we must wander on in life with great uncertainty, and may often plunge into calamities and misfortunes, by those very pursuits from which we expected nothing but joy and pleasure.

SECTION VI.

Recapitulation.

Thus have I gone though the several divisions of our ideas, which I have endeavoured to represent in such a manner as their vast extent may most easily appear, and the conduct of the mind in framing them be distinctly apprehended. I might easily run into other distinctions, by considering them as clear or obscure, adequate, or inadequate, true or false. But the limits of this tract will not allow my entering more fully into the subject, and I think it the less needful, because the very names are almost sufficient to convey a notion of these several kinds of ideas into the mind. But as the division explained above seems to be of great importance, towards settling in the understanding a just view of the progress of human knowledge, and the steps by which it advances from one degree of improvement to another, I shall here run over it again in as few words as possible, that the whole process may be seen at once. Our ideas are all derived into the understanding, either by sensation or reflection. This, however, is observable, that one and the same object often excites a variety of perceptions at once, which are nevertheless readily distinguished by the mind, and appear each under a form peculiar to itself. These constitute our primary and original notices, and are easily known from all others, in as much as they are entirely void of plurality, and cannot be divided into two or more different ideas. They are also the materials out of which the others are formed, and are therefore, by way of distinction, called simple ideas. But the mind, though it has no power over these, either to fashion or destroy them, can yet combine them in an infinite number of ways; and from their various combinations result all our complex ideas, which are of two principal kinds. First, such as are derived from without, and represent those combinations of simple ideas, that have a real existence in nature. Of this sort are all our ideas of substances. Secondly, the conceptions formed by the mind itself, arbitrarily uniting and putting together its ideas. And as this makes by far the largest class, and comprehends all those ideas which may be properly termed our own, as being the real workmanship of the understanding; so they fall very naturally under three distinct heads. For either the mind combines several simple ideas together, in order to form them into one conception, in which the number and quality of the ideas united are principally considered; and thus it is we come by all our compound notions: or it fixes upon any of its ideas, whether simple, compound, or of substances; and leaving out the circumstances of time, place, real existence, and whatever renders it particular, considers the appearance alone, and makes that a representative of all of the kind; whence our abstract and universal ideas are derived: or lastly it compares things one with another, examines their mutual connections, and thereby furnishes itself with a new set of notions, known by the name of relations, which, as has been already remarked, make by no means the least important class of our perceptions. This division of our ideas, as it seems to be the most natural, and truly to represent the manner in which they are introduced into the mind, so I believe it will be found to comprehend them in all their varieties. I shall therefore now proceed to offer some observations upon language, as being the great instrument by which we are enabled to make our ideas and perceptions known to others.

CHAP. V.

OF WORDS, CONSIDERED AS THE SIGN OF OUR IDEAS.

SECTION I.

Words furnish the Means of recording our own Thoughts.

We have seen how the mind comes to be first furnished with Ideas, and by what methods it contrives to diversify and enlarge its stock; let us now consider the means of making known our thoughts to others, that we may not only understand how knowledge is acquired, but also in what manner it may be communicated with the greatest certainty and advantage. For our ideas, though manifold and various, are nevertheless, all within our own breasts, invisible to others, nor can of themselves be made to appear. But God designed us for society, and to have a fellowship with those of our kind, has provided us with organs fitted to frame articulate sounds, and given us also a capacity of using those sounds as signs of internal conceptions. Hence spring words and languages; for having once pitched upon any sound, to stand as the mark of an idea in the mind, custom, by degrees, establishes such a connection between them, that the appearance of the idea in the understanding always brings to our remembrance the sound or name by which it is expressed; as, in like manner, the hearing of the sound never fails to excite the idea for which it is made to stand. And thus it is easy to conceive, how a man may record his own thoughts, and bring them again into view, in any succeeding period of life. For this connection being once settled, as the same sounds will always serve to excite the same ideas: if he can but contrive to register his words, in the order and disposition in which the present train of his thoughts presents them to his imagination, it is evident he will be able to recall these thoughts at pleasure, and that too in the very manner of their first appearance. Accordingly we find, that the inventions of writing and painting, by enabling us to fix and perpetuate such perishable things as sounds, have also furnished us with the means of giving a kind of permanency to the transactions of the mind, insomuch that they may be in the same manner subjected to our review, as any of the other abiding objects of nature.

SECTION II.

And of the mutual Communication of Knowledge from one Man to another.

But besides the ability of recording our own thoughts, there is this farther advantage in the use of external signs, that they enable us to communicate our sentiments to others, and also receive information of what passes in their breasts. For any number of men, having agreed to establish the same sounds as signs of the same ideas, it is apparent, that the repetition of these sounds must excite the like perceptions in each, and create a perfect correspondence of thoughts. When, for instance, any train of ideas succeed one another in my mind, if the names, by which I am wont to express them, have been annexed by those with whom I converse, to the very same set of ideas, nothing is more evident, than that by repeating those names, according to the tenor of my present conceptions, I shall raise in their minds the same course of thought as has taken possession of my own. Hence, by barely attending to what passes within themselves, they will also become acquainted with the ideas in my own understanding, and have them in a manner laid before their view. So that we here clearly perceive, how a man may communicate his sentiments, knowledge, and discoveries to others, if the language in which he converses, be extensive enough to mark all the ideas and transactions of his mind. But as this is not always the case, and men are often obliged to invent terms of their own, to express new views and conceptions of things; it may be asked, how, in these circumstances, we can become acquainted with the thoughts of another, when he makes use of words to which we have never annexed any ideas, and which, of course, can raise no perceptions in our minds? Now, in order to unveil this mystery, and give some little insight into the foundation, growth, and improvement of language, the following observations will, I am apt to think, be found of considerable moment.

SECTION III.

Simple Ideas cannot be conveyed into the Mind, by Words, or a Description;

First, that no word can be to any man the sign of an idea, till that idea comes to have a real existence in his mind. For names being only so far intelligible, as they denote known internal conceptions, where they have none such to answer them, there they are plainly sounds without signification, and of course convey no instruction or knowledge. But no sooner are the ideas to which they belong raised in the understanding, than finding it easy to connect them with the established names, we can join in any agreement of this kind made by others, and thereby enjoy the benefit made by their discoveries. The first thing, therefore, to be considered, is, how these ideas may be conveyed into the mind; that, being there, we may learn to connect them with their appropriated sounds, and so become capable of understanding others, when they make use of these sounds in laying open and communicating their thoughts. Now, to comprehend this distinctly, it will be necessary to call to mind the before mentioned division of our ideas into simple and complex. And first, as for our simple ideas, it has been already observed, that they can find no admission into the mind, but by two original fountains of knowledge, sensation and reflection. If, therefore, any of these have as yet no being in the understanding, it is impossible by words, or a description, to excite them there. A man, who had never felt the impression of heat, could not be brought to comprehend that sensation, by any thing we might say to explain it. If we would really produce the idea in him, it must be by applying the proper object to his senses, and bringing him within the influence of a hot body. When this is done, and experience has taught him the perception to which men have annexed the name, *heat*, it then becomes to him the sign of that idea : and he thenceforth understands the meaning of a term, which, before, all the words in the world would not have been sufficient to convey into his mind. The case is the same in respect of light and colours. A man born blind, and thereby deprived of the only conveyance for the ideas of this class, can never be brought to understand the names by which they are expressed. The reason is plain: they stand for ideas that have no existence in his mind ; and as the organ appropriated to their reception is wanting, all other contrivances are vain, nor can they, by any force of description, be raised in his imagination. But it is quite otherwise in our complex notions. For these being no more than certain combinations of simple ideas put together in various forms—if the original ideas, out of which these collections are made, have already got admission into the understanding, and the names serving to express them are known—it will be easy, by enumerating the several ideas concerned in the composition, and marking the order and manner in which they are united, to raise any complex conception in the mind. Thus the idea answering to the word *rainbow*, may be readily excited in the imagination of another, who has sever seen the appearance itself, by barely describing the figure, largeness, position, and order of colours ; if we suppose these several simple ideas, with their names, sufficiently known to him.

SECTION IV.

The Nature of Complex Ideas definable; those of Simple Ideas not.

And this naturally leads me to a second observation upon this subject, namely, that words standing for complex ideas are all definable; but those, by which we denote simple ideas, are not. For the perceptions of this latter class, having no other entrance into the mind than by sensation or reflection, can only be acquired by experience from the several objects of nature, proper to produce those perceptions in us. Words, indeed, may very well serve to remind us of them, if they have already found admission into the understanding, and their connexion with the established names is known: but they can never give them their original being and existence there. And hence it is, that when any one asks the meaning of a word denoting a simple idea, we pretend not to explain it to him by a definition, well knowing that to be impossible; but supposing him already acquainted with the idea, and only ignorant of the name by which it is called, we either mention it to him by some other name, with which we presume he knows its connexion, or appeal to the object where the idea itself is found. Thus was any one to ask the meaning of the word *white*, we should tell him it stood for the idea, as *albus*, in *Latin*, or *blanc*, in *French;* or, if we thought him a stranger to these languages, might appeal to an object producing the idea, by saying, it denoted the colour we observe in *snow* or *milk*. But this is by no means a definition of the word, exciting a new idea in his understanding; but merely a contrivance to remind him of a known idea, and teach him its connection with the established name. For if the idea after which he inquires, has never yet been raised in his mind—as suppose one who had seen no other colours than *black* and *white*, should ask the meaning of the word *scarlet*—it is easy to perceive, that it would be no more possible to make him comprehend it by words, or a definition, than to inculcate the same perception into the imagination of a man born blind. The only method in this case, is, to present some object, by looking at which the perception itself may be excited; and thus he will learn both the name and the idea together.

SECTION V.

Experience and Observation bring Men to an Agreement in the Names of Simple Ideas.

Should any one's curiosity now prompt him to inquire, how it comes to pass, that men agree in their names of the simple ideas, seeing they cannot view the perceptions in one another's minds, nor make known these perceptions by words to others; I answer, that the effect here mentioned is produced by experience and observation. Thus finding, for instance, that the name, *heat*, is annexed to that impression which men feel when they approach the fire, I make it also the sign of the idea excited in me by such an approach, nor have any doubt, but it denotes the same perception in my mind as in their's. For we are naturally led to imagine, that the same objects operate alike upon the organs of the human body, and produce an uniformity of sensations. No man fancies that the idea raised in him by the taste of *sugar*, and which he calls *sweetness*, differs from that excited in another by the like means; or that *wormwood*, to whose relish he has given the epithet *bitter*, produces in others the sensation which he denotes by the word *sweet*. Presuming therefore, upon the conformity of perceptions, when they arise from the same objects, we easily agree as to the names of our simple ideas; and if at any time, by a more narrow scrutiny into things, new ideas of this class come in our way, which we choose to express by terms of our own invention; these names are explained not by a definition, but by referring to the objects, whence the ideas themselves may be obtained.

SECTION VI.

The Conveyance of Complex Ideas by Definitions, a wise Contrivance in Nature.

Being in this manner furnished with simple ideas, and the names by which they are expressed, the meaning of terms that stand for complex ideas is easily attained; because the ideas themselves answering to these terms, may be conveyed into the mind by definitions. For our complex notions, as was already observed, are only certain combinations of simple ideas. When, therefore, these are enumerated, and the manner in which they are united into one conception explained, nothing more is wanting to raise that conception in the understanding; and thus the term denoting it comes of course to be understood. And here it is worth while to reflect a little upon the wise contrivance of nature, in thus furnishing us with the very aptest means of communicating our thoughts. For were it not so ordered, that we could thus convey our complex ideas from one to another by definitions, it would in many cases be impossible to make them known at all. This is apparent in those ideas which are the proper work of the mind. For as they exist only in the understanding, and have no real objects in nature, in conformity to which they are framed—if we could not make them known by a description, they must lie forever hidden within our own breasts, and be confined to the narrow acquaintance of a single mind. All the fine scenes, that rise from time to time in the poet's fancy, and, by his lively painting, give such entertainment to his readers—were he destitue of this faculty of laying them open to the view of others by words and descriptions—could not extend their influence beyond his own imagination, or give joy to any but the original inventor.

SECTION VII.

And of great avail towards the Improvement of Knowledge.

There is this farther advantage in the ability we enjoy, of communicating our complex notions by definitions; that as these make by far the largest class of our ideas, and most frequently occur in the progress and improvement of knowledge; so they are by this means imparted with the greatest readiness, than which nothing could tend more to the increase and spreading of science. For a definity is soon perused, and if the terms of it are well understood, the idea itself finds an easy admission into the mind. Whereas in simple perceptions, where we are referred to the objects producing them, if these cannot be come at, as is sometimes the case, the names by which they are expressed must remain empty sounds. But new ideas of this class occurring very rarely in the sciences, they seldom create any great obstruction. It is otherwise with our complex notions; for every step we take, leading us into new combinations and views of things, it becomes necessary to explain these to others, before they can be made acquainted with our discoveries. And as the manner of definitions is easy, requiring no apparatus but that of words, which are always ready, and at hand; hence we can, with the less difficulty, remove such obstacles, as might arise from terms of our own invention, when they are made to stand for new complex ideas, suggested to the mind by some present train of thinking. And thus at last we are let into the mystery hinted at in the beginning of this chapter, viz. how we may become acquainted with the thoughts of another, when he makes use of words to which we have as yet joined no ideas. The answer is obvious from what has been already said. If the terms denote simple perceptions, he must refer us to those objects of nature, whence the perceptions themselves are to be obtained; but if they stand for complex ideas, their meaning may be explained by a definition. As for the names of simple ideas, I shall here dismiss them; it being sufficient to take notice, that our knowledge this way can be extended only by experience and observation. But the theory of definitions making a material part of logic, and being indeed of great importance towards the improvement of human knowledge, it will be necessary to lay it a little more open to the view of the reader.

SECTION VIII.

The Composition and Resolution of our Complex Ideas.

Complex ideas are, as has been already said, no other than simple ideas put together in various forms. But then it is to be observed, that in making these collections, the mind is not always tied down to the immediate view of the simple perceptions out of which they are framed. For if we suppose the understanding already furnished with a considerable stock of compound notions, these again may be made the constituent parts of others still more compounded, insomuch that the new idea thence arising may be termed a combination of complex conceptions. Thus the idea annexed to the word *animal*, includes many perceptions under it, as life, sense, spontaneous motion, &c. In the like manner by the term *rational*, we denote a variety of simple ideas. If now, combining these two conceptions together, we form the still more complex notion of a rational animal; the idea thus got is truly a collection of compound notices. In a word, the same thing happens here as in numbers, which we may consider not only as various collections of units, these being indeed their original and constituent parts; but also as sometimes composed of other lesser numbers, which, all put together, make up the respective sums. Now, in tracing any very large number, when, for the ease of the mind, we consider it at first as composed of various others still less—if we next take these less parts to pieces, and pursue them continually, until we arrive at the units out of which they are composed; we thereby totally unravel the collection, and being able to push our researches no farther, rest satisfied in the view thus offered to the understanding. Just so it is in the examination of our complex ideas. For when any very compounded notion comes under the inspection of the mind, in order to be traced to its first principles—we begin with resolving it into other ideas less complicated; and taking these again to pieces, one by one, still go on with the search until we have broken the whole into our first and simple perceptions, beyond which the pursuit cannot possibly be carried. And this is the reason why I have all along called our simple ideas the foundation and ground work of human knowledge; because, in unravelling the conceptions of the mind, we find ourselves at length bounded by these ideas, which are indeed the last resort of the understanding.

SECTION IX.

The Names of Simple Ideas may be considered as the Elementary Parts of Language.

From what has been said, it will be easy to conceive how, in defining a term, standing for any very complex idea, other terms may be introduced, that also denote compound ideas, though of an inferior class. For the first idea being resolvable into others less complicated, the definition which enumerates these component ideas, must consist of the names by which they are expressed. And if it so happen, that the ideas of this second class are also unknown, their terms, too, ought to be still farther defined. In this manner may a series of definitions be carried on, until we arrive at the names of simple ideas, which not being definable, the analysis must necessarily cease. And thus we see, that as our simple ideas are the materials and foundation of knowledge, so the names of simple ideas may be considered as the elementary parts of language, beyond which we cannot trace the meaning and signification of words. When we come to them, we suppose the ideas they stand for already known; or, if they are not, experience alone must be consulted, and not definitions or explications. And here it is well worth our notice, that as the names of these our original conceptions constitute the primitive and fundamental articles of speech, upon which the whole superstructure of human language is built, so they are, of all others, the least doubtful and uncertain in their signification. Because, standing each for one simple perception, not precariously excited in the mind, but the effect of certain powers in things fitted to produce that sensation in us, there is no danger of error or mistake. He that once knows *sweetness* to be the name of the taste received from sugar, *whiteness* of the colour in snow or milk, and *heat* of the sensation produced by approaching the fire, will not be apt to misapply those words, or annex them to perceptions of a different kind. And as the names of complex ideas may all be resolved into these primitive terms, it is apparent, that we are sufficiently provided with the means of communicating our thoughts one to another; and that the mistakes so frequently complained of on this head, are wholly owing to ourselves, in not sufficiently defining the terms we use, or perhaps not connecting them with clear and determinate ideas.

CHAP. VI.

OF DEFINITION, AND ITS SEVERAL KINDS.

SECTION I.

The variety of Definitions proceeds from the various Application of Words.

HAVING laid these foundations, shown what words are, and what are not definable, and taught the manner of resolving our notions, as well as language itself, into its first and original principles; we now proceed to explain a little more particularly the nature of a definition, and the several kinds made use of, according to the different views men have in communicating their thoughts one to another. Definitions are intended to make known the meaning of words standing for complex ideas ; and were we always careful to form those ideas exactly in our minds, and copy our definitions from that appearance, much of the confusion and obscurity complained of in languages might be prevented. But unhappily for us, we are by no means steady in the application of names, referring them sometimes to one thing, sometimes to another, which often creates great uncertainty in their signification, and obliges us to give a different turn to our definitions, according to the different reference of the terms defined. In order, therefore, to render this whole matter as clear and obvious as possible, we shall first consider to what it is that names, in the use of language, are most commonly applied ; and then from the variety of this application, endeavour to account for the several methods of defining, mentioned in the writings of logicians.

SECTION II.

Words have a threefold Reference ; to our own Ideas, those of others, and the real being of Things.

Words then have manifestly a threefold reference. First, and more immediately, they denote the ideas in the mind of him who uses them ; and this is their true and proper signification. When a man speaks it is that he may be understood ; and the words he employs to convey his thoughts, are such as by use he has learned to connect with the ideas then present to his mind. But because those with whom we converse, are also supposed to know the meaning of the terms we use, hence, secondly, we consider our words as signs, likewise, of the ideas in their minds ; and this is the foundation of what is called propriety in language, when men take care to affix such notions to their words, as are commonly applied to them by those of most understanding in the country where they live. The third and last reference of words is to things themselves. For many of our ideas are taken from the several objects of nature, wherewith we are surrounded; and being considered as copies of things really existing, the words, by which they are expressed, are often transferred from the ideas themselves, to signify those objects which they are supposed to represent. Thus the word, sun, not only denotes the idea excited in the mind by that sound, but is also frequently made to stand for the luminous body itself, which inhabits the centre of this our planetary system. Now, according to this threefold application of names, their definitions, and the manner of explaining them, must be various; for it is one thing to unfold the ideas in a man's own mind, another to describe them, as they are supposed to make their appearance in the minds of others; and lastly, it is something still different to draw images or pictures, that shall carry in them a conformity to the being and reality of things. But we shall treat of each in order.

SECTION III.

Definitions of the Name teach only the Connexion of our Words and Ideas, and are therefore arbitrary.

First, then, when we consider words as signs of the ideas in the mind of him who uses them; a definition is nothing else, but such an explication of the meaning of any term, as that the complex idea annexed to it by the speaker, may be excited in the understanding of him with whom he converses. And this is plainly no more than teaching the connexion of our words and ideas, that others may understand the sense of our expressions, and know distinctly what notions we affix to the terms we use. When we say, for instance, that by the word *square* we mean a figure bounded by four equal sides, joined together at right angles; what is this but a declaration, that the idea of a quadrilateral, equilateral, rectangular figure, is that which in discourse or writing we connect with the term *square?* This is that kind of definition, which logicians call the *definition of the name;* because it discovers the meaning of the words or *names* we make use of, by showing the ideas for which they stand. Now, as sounds are of themselves indifferent to signify any ideas, hence it is plain, that the definitions of names are arbitrary, every man having a liberty to affix what notions he pleases to his words. But the convenience of communication making it necessary for men speaking the same language to agree as nearly as possible in the signification of sounds, a conformity has accordingly been studied. Nevertheless, we find that differences will, from time to time, creep in, which must create great confusion in men's discourses and reasonings, if they are not careful to define their terms, that their signification may be kept fixed and steady, and lie always open to the view of the mind. The writings of the mathematicians are a clear proof, how much the advancement of human knowledge depends upon a right use of definitions. For as by means of them they every where preserve the same determined significations to their words, hence there is little dispute as to the meaning of their expressions, almost all men understanding them in the same sense. And thus it happens, that such as apply their thoughts this way, having perfectly the same views of things, readily comprehend the discoveries already made, and are thereby enabled with joint labour, and an exact conformity of notions, to carry on the improvement of this branch of knowledge. And if men in other parts of learning, were alike careful to fix the meaning of their terms, the progress of science must be greatly furthered, and all those verbal disputes, that now so much interrupt the course of our improvements, might be prevented.

SECTION IV.

Definitions of the Name not always true and real Definitions;

This then ought to be our first care, when we enter upon a design of illustrating any particular branch of study; to ascertain our ideas, and mark the names by which they are expressed. And although definitions of words are indeed arbitrary, (for a man may affix what ideas he pleases to his terms, nor can any one contest this liberty with him,) yet it will be proper to conform, as near as possible, to common acceptation, that thereby our thoughts may find a more easy and ready entrance into the minds of others. If it should now be asked, what are the rules of a good definition, I answer, that as in definitions of the name, we aim at no more than teaching the connexion of words and ideas; every contrivance by which we are enabled to excite the idea annexed to any word in the mind of another, will serve the purpose of a definition. Now the ideas we join with our words are of two kinds: either such as we have reason to believe are already in the minds of others, though perhaps they know not the names by which they are called; or such as, being new and of our own formation, can be no otherwise made known than by a description. In the first case, there is no necessity for laying open the idea itself, because, being already known, any contrivance to remind us of it is sufficient. When we say, for instance, that a *clock is an instrument, by which we measure the hours of the day;* it is plain, that the idea answering to the word *clock* is not here unfolded; but we being before hand supposed to have an idea of this instrument, are only taught by what name it is called. Now, in this sense, the names of even simple ideas may be defined. For, by saying that *white* is the colour we observe in snow or milk, *heat*, the sensation produced by approaching the fire, we sufficiently make known what ideas we connect with the terms *white* and *heat*, which is the true purpose of a definition of the name. Hence it appears, that many of those explanations of words, which logicians call definitions of the name, are not definitions in a true and proper sense, that is, such descriptions of ideas, as would serve to excite them in the mind of another, even supposing him before wholly unacquainted with them, but merely contrivances to remind us of known ideas, and teach us the names by which they are called.

SECTION V.

But only when they coincide with the Definition of the Thing.

But where the ideas we join with our words are new and of our own formation, there they are to be laid open by a description, because, being supposed unknown to others, we must first raise them in their minds, before they can learn to connect them with any particular names. And here it is, that the definition of the name coincides with what logicians call the definition of the thing, as in either case we proceed by unfolding the idea itself for which the term defined stands. And indeed this alone is what constitutes a definition, in the true and proper sense of the word, as will appear more fully afterwards, when we come to consider the terms we use, as referred to the real objects of nature. We shall therefore postpone this consideration of the definition of the name, till we come to treat of the definition of the thing, when it will more naturally fall in our way. It may not, however, be amiss to observe, that when we say the definitions of the name are arbitrary, we mean not that the descriptions of ideas are so too. For every idea having a peculiar appearance of its own, by which it is distinguished from all others, nothing is more evident, than that the description must be such as to exhibit that precise conception. But then the connexion of any idea, with the name by which it is expressed, being, as we have said, wholly arbitrary, the considering the description of that idea as the definition of that particular name must be so too. So that although definitions, considered as descriptions of our ideas, are steady and invariable, yet the application of them to particular sounds, (which is all that we understand by the definition of the name) is wholly a work of our own free choice.

SECTION IV.

Definition of Words according to the common use of Language not Arbitrary.

But secondly, besides considering words as the signs of our own ideas, we are also very apt, on many occasions, to refer them to the ideas in the minds of other men. Now, to define a term, in this view, is to investigate its meaning or acceptation, according to the common use of speech. Here then it is plain, that definitions are not arbitrary. For although in regarding words as the marks of our own ideas, we may give them what meaning we please; yet when we consider them in reference to the thoughts of others, they have a fixed and steady signification, namely, that which custom and the propriety of language has assigned them. The words *ability* and *genius* may, by any man, be made to stand for one and the same idea in his own mind, and if he takes care to advertise us of this, he is at liberty to use them promiscuously. But if the common course of language hath confined the word *genius* to express the natural strength and talents of the mind, and the word *ability* to denote those which are acquired, whoever pretends to explain the proper acceptation of these terms, is bound to take notice of this difference. As propriety o speech makes our language intelligible, and gives our thoughts a ready entrance into the minds of others, it well deserves our application and care. The best way to acquire it is from the writings and discourses of those who seem to have had the clearest notions, and to have applied their terms with the exactest choice and fitness.

SECTION VII.

Definitions of the Thing refer to the real Objects of Nature.

We come now to the third and last species of definition, that, namely, which considers words as referred to things themselves. And here it is plain, we are not at liberty to feign and fashion our explications at pleasure, but being tied down to the real objects of nature, must study a conformity to things themselves. When we define, for instance, the sun, considered as that being who possesses the centre of our system, and diffuses heat and light to the planets around him; it is not enough that we give an account of the idea answering to that word in our minds. We must further take care, that the idea itself carries it in a real conformity to the object it is supposed to represent. And hence it is, that all definitions of this kind, when justly made, are in reality pictures or representations, taken from the being and existence of things. For they are intended to express their nature and properties so as to distinguish them from all others, and exhibit them clearly to the view of the mind. 'Tis for this reason that logicians call them definitions of things, because they are supposed to refer, not so much to the ideas in the understanding, as to the things themselves represented by those ideas.

SECTION VIII.

Ground of the Distinction between the Definition of the Name and of the Thing.

And this also lets us into the ground of that distinction so universally received between definitions of the name and of the thing. The first are arbitrary, and not liable to debate or contradiction. The second are propositions, capable of proof and illustration, and which may therefore be contested. The reason is obvious. Definitions of the name serve only to mark what ideas we connect with our words. And as sounds are of themselves indifferent to signify any ideas, we are entirely at liberty to affix to them what notions we please. But it is otherwise in the definition of the thing. For here our words serving to denote particular beings in nature, cannot be the signs of any ideas at pleasure, but of such only as carry in them a conformity to the several objects to which the words refer. A man may use the term *square*, to express that idea which others denote by the word *triangle*, and define it accordingly. In this case, indeed, he recedes from the common forms of speech, but his definition cannot be charged with falsehood. He tells us that by a *square* he means a three-sided figure; and who can dispute the truth of this, if he really all along uses the word in that sense? I would only observe, that by changing thus the meaning of words, we change not things themselves, or their relations and habitudes one towards another. These are at all times the same and invariable, nor have any dependence upon the fancy and caprice of men. It is true, the properties of the *triangle* may, after this definition, be affirmed of the *square*; but as, in either case, the idea to which these properties belong is the same, the propositions only expressing our judgments, and not our judgments themselves, suffer a seeming variation.

SECTION IX.

A previous connexion between Names and Things, cuts off all Arbitrary Explications.

But where words are made to denote particular objects, previous to any definitions given, there arbitrary explications cannot have place. For in this case, we are not put upon explaining what ideas we connect with our words, but a connexion being already supposed between the name and the thing signified, our business is to unfold that idea by which the object itself is most clearly and distinctly represented. Thus the word *gold* denotes that metal which is of highest value among men, and goes farthest in the way of commerce. This connexion being once settled, we are no longer left to arbitrary definitions, but must describe it by such properties as are really to be found in it, and will best serve to distinguish it when it comes in our way; as by saying it is a substance, yellow, very heavy, malleable, fusible, &c.

SECTION X.

Why Mathematical Definitions have been accounted mere Definitions of the name;

From what has been said it appears, that in the language of logicians, definitions of the thing respect only substances and beings that have a real existence in nature, serving to describe them by their properties and attributes. And this, I doubt not, is the reason, that the definitions of the mathematicians are not considered as definitions of the thing, but of the name; because the ideas therein described, are the mere creatures of the understanding, and not supposed to be copied from patterns existing without us. A circle, a triangle, a square, &c. such as mathematicians conceive them, are no where to be found in nature, that we know of. Hence it might justly be accounted absurd, to call our definitions of these *definitions of the thing*, when they serve not to describe any real objects of nature, but merely to unfold the conceptions of the mind. And yet if we look into the matter narrowly, we shall find, that the rules followed in these definitions are precisely the same with those which logicians have laid down for the definition of the thing. All the several species of figures are described by their properties, some of which are common to different ranks, others peculiar to the tribe defined. The common properties constitute what logicians call the *genus*, and those that are peculiar, the *difference*. Now the *genus* and *difference* make up the logical definition of the thing, as will be more clearly understood from what follows.

SECTION XI.

When yet they coincide with the logical Definition of the Thing, and therefore ought not to be accounted arbitrary.

I am, therefore, apt to think, that mathematical definitions, as they are of the same general with the definitions of substances, and subject to the same rules, have been improperly considered as mere definitions of the name, in which we are left wholly to arbitrary explications. For however we may change the name of one figure for another in discourse or writing, using the term *square* to denote a *triangle*, or the word *triangle* to express a *square*, it is certain the ideas themselves are invariable, and no less capable of being distinguished by their properties, than the several species of substances. Thus if we suppose the word *square* to denote that species of figures, whose sides severally subtend quadrants of a circumscribed circle, we shall find ourselves equally shut out from arbitrary explications as in the definition of the names of substances. For as this happens in no figures but those which are bounded by four equal sides joined together at right angles; it follows evidently, that the true and proper definition of a square, is that which exhibits the precise idea here mentioned, and no other, to the mind. And thus it appears, that the common division of definitions, into those of the name and thing, is not sufficiently calculated to give us right apprehensions, as to what is and what is not arbitrary in the explication of words. It may not, therefore, be improper, if we here endeavour to clear up this matter a little, and free it from those obscurities in which it has hitherto been involved. To this end we shall premise the following observations.

SECTION XII.

Definitions, properly speaking, never regard Things, but merely our own Ideas.

1. First, that whatever logicians may pretend about the definition of the thing, it is yet certain that none of our definitions, when pursued to their source, regard immediately things themselves, but merely the ideas in our own minds. This, I doubt not, will appear a paradox to many, who will be apt to inquire, whether the definition of *gold* be not taken from that metal, independent of the various conceptions of men about it. To this I answer,

that indeed in framing our idea of *gold*, we regard chiefly the thing itself, uniting in our conceptions such properties as are most conspicuuos, and serve best to distinguish it from other metals, to which it may bear any resemblance. But as it is by this idea alone that gold is known to us, so in describing it to others, we aim at nothing more than to transfer the same conception into their minds. Now this can no otherwise be done, but by enumerating the several properties of which our own complex notion is formed. And indeed it were in the highest degree absurd to imagine, that men, in explaining things to others, should make use of any marks or characters but those by which they are known to themselves. Hence it comes to pass, that all our definitions are in fact nothing else but transcripts of the ideas in our minds. Where these are imperfect, the definitions must be so too; where they are just and adequate, the copies taken from them, if drawn out with accuracy and care, cannot fail to exhibit the object described. And this will very well serve to account for that great diversity of definitions we often meet with, even of one and the same object. Because men, in consequence of their different pursuits and applications, falling often into different views of things, must needs vary no less in their definitions, than in the ideas themselves from which these definitions are copied. He, whose observation goes no farther than the more obvious qualities of gold, will content himself with describing it by its colour, weight, and perhaps malleability and fusibility. On the other hand, a goldsmith, having inquired farther into the nature of that metal, and finding several other properties that equally belong to it, will be apt to take these also into his complex idea, and accordingly introduce them in a definition. Hence his description will add to the former, fixedness, and solubility in *aqua regia*, &c. And so in proportion as men's various pursuits lead them into a more accurate examination of things, their explications will take a different turn, suitable to the ideas they have framed within themselves.

SECTION XIII.

Distinction between the Definition of the Name and Thing useless, and to be rejected.

2. This then being evident, that our definitions respect not things themselves, but the ideas in our own minds ; I would in the next place observe, that the distinction of them into those of the name and thing, is altogether useless, and tends rather to mislead us than give right apprehensions of the subject in hand. For thus men are apt to fancy, that many of their definitions are expressive of the real essence of things, whereas they are in truth no more than transcripts of their own ideas. And as it sometimes falls out, that these ideas are not collected with sufficient care, from the objects they represent ; we find, by experience, that a mistaken idea never fails to occasion a mistake also in the definition. But this could not happen, were our definitions copied from things themselves : because their essences being immutable, and always the same, the definition would in this case serve to correct the idea, and might be considered as a standard by which to judge whether the idea was rightly framed. I deny not, that words are often transferred from our ideas to signify the objects which these ideas represent ; as when we talk of the sun, the earth, men, and other animals. But then let it be observed, that as these objects are only known to us by the ideas of them in our minds ; so, in describing them to others, all we aim at is, distinctly to lay open our conceptions about them. Hence it appears, that what logicians call a *definition of the thing*, is in truth no more than an unfolding of the idea by which that thing is represented to the understanding. But now in mathematical definitions, and indeed all others whatsoever, this also is our whole aim and intent, to exhibit and lay open those ideas, of which the words we use are signs. And thus it happens, that in innumerable instances, what logicians call the *definition of the name*, is yet found to coincide with

and proceed by the very same rules, as the *definition of the thing;* which clearly demonstrates the necessity of banishing this frivolous distinction, and establishing some precise and determinate notion, expressive of the true nature of a definition, and comprehending it in its full extent.

SECTION XIV.

Definitions in all cases descriptions of our Ideas.

Nor will this appear so difficult a task, if we call to mind that words are in all cases the signs of our ideas, and no otherwise signify things, than as they stand for those ideas by which things are represented to the understanding. By defining our words, therefore, we can mean no more, than the laying open to the view of others, the ideas of which these words are the signs. For thus it is, that the meaning of our expressions comes to be known, and that we find ourselves capable of transferring our thoughts and conceptions into the minds of those with whom we converse. Where words are referred to things themselves, there we explain the ideas by which these things are represented; where they denote conceptions framed by the mind, there we lay open these conceptions, and endeavor to exhibit them according to their real appearance within our own breasts. But in both cases, it is our own ideas, it is the perceptions of our own minds, either as taken from things without, or framed by the understanding itself, that we explicate and unfold.

SECTION XV.

Not arbitrary, as being confined to the Representation of certain determinate Notions.

And thus we have at length settled the true and genuine notion of a definition, comprehending all its varieties, from whatever science taken, or to whatever object extended. For from what we have said, it evidently follows, that a definition is the unfolding of some conception of the mind, answering to the word or term made use of as the sign of it. Now, as in exhibiting any idea to another, it is necessary that the description be such as may excite that precise idea in his mind; hence it is plain, that definitions, properly speaking, are not arbitrary, but confined to the representing of certain determinate settled notions, such, namely, as are annexed by the speaker or writer to the words he uses. As, nevertheless, it is universally allowed that the signification of words is perfectly voluntary, and not the effect of any natural and necessary connexion between them and the ideas for which they stand, some may perhaps wonder why definitions are not so too. In order, therefore, to unravel this difficulty, and show distinctly what is, and what is not arbitrary in speech, we must carefully distinguish between the connexion of our words and ideas, and the unfolding of the ideas themselves.

SECTION XVI.

The Connexion between Words and Ideas, a perfectly voluntary Establishment.

First, as to the connexion of our words and ideas, this it is plain, is a purely arbitrary institution. When, for instance, we have in our minds the idea of any particular species of metals, the calling it by the name *gold*, is an effect of the voluntary choice of men speaking the same language, and not of any peculiar aptness in that sound to express that idea. Other nations, we find, make use of different sounds, and with the same effect. Thus *aurum* denotes that idea in Latin, and *or* in French. And even the word *gold* itself would have as well served to express the idea of that metal which we call *silver*, had custom in the beginning so established it.

SECTION XVII.

The Descriptions of Ideas not so, but bounded to the Representation of that precise Appearance by which they are distinguished among themselves.

But although we are thus entirely at liberty, in connecting any idea with any sound, yet it is quite otherwise in unfolding the ideas themselves. For every idea, having a precise appearance of its own, by which it is distinguished from every other idea, it is manifest, that in laying it open to others, we must study such a description, as shall exhibit that peculiar appearance. When we have formed to ourselves the idea of a figure bounded by four equal sides, joined together at right angles, we are at liberty to express that idea by any sound, and may call it either a *square* or a *triangle*. But which ever of these names we use, so long as the idea is the same, the description by which we would signify it to another must be so too. Let it be called *square* or *triangle*, it is still a figure having four equal sides, and all its angles right ones. Hence we clearly see what is, and what is not arbitrary in the use of words. The establishing any sound, as the mark of some determinate idea in the mind, is the effect of free choice, and a voluntary combination among men. And as different nations make use of different sounds to denote the same ideas, hence proceeds all that variety of languages which we meet with in the world. But when a connexion between our ideas and words is once settled, the unfolding of the idea answering to any word, which properly constitutes a definition, is by no means an arbitrary thing. For here, as I have already observed, we are bound to exhibit that precise conception, which either the use of language, or our own particular choice, hath annexed to the term we use.

SECTION XVIII.

Causes of the Obscurity that has hitherto perplexed the Theory of Definitions.

And thus it appears, that definitions, considered as descriptions of ideas in the mind, are steady and invariable, being bounded to the representation of those precise ideas. But then in the application of definitions to particular names, we are altogether left to our own free choice. Because as the connecting of any idea with any sound is a perfectly arbitrary institution, the applying the description of that idea to that sound must be so too. When, therefore, logicians tell us, that the definition of the name is arbitrary, they mean no more than this, that as different ideas may be connected with any term, according to the good pleasure of him that uses it, in like manner may different descriptions be applied to that term, suitable to the ideas so connected. But this connexion being settled, and the term considereed as the sign of some fixed idea in the understanding, we are no longer left to arbitrary explications, but must study such a description as corresponds with that precise idea. Now this alone, according to what has been before laid down, ought to be accounted a definition. What, I am apt to think, has occasioned no small confusion in this matter, is, that many explanations of words, where no idea is unfolded, but merely the connexion between some word and idea asserted, have yet been dignified with the name of definitions. Thus, in the instance before given, when we say that a clock is an instrument by which we measure time, this is by some called a definition. And yet it is plain, that we are beforehand supposed to have an idea of this instrument, and only taught that the word *clock* serves in common language to denote that idea. By this rule all explications of words in our dictionaries will be definitions; nay, as was already observed, the names of even simple ideas may be thus defined. *White*, we may say, is the colour we observe in snow or milk, *heat* the sensation produced by approaching the fire, and so in innumerable other instances. But these, and all others of the like kind, are by no means definitions, exciting new ideas in the understanding, but merely contrivances to remind us of known ideas, and teach their connexion with the established names. It is, nevertheless, worth our notice, that what logicians call definitions of the name, extend properly no farther than these explanations, serving to mark the connexion of our ideas and words : and are therefore justly accounted arbitrary, inasmuch as the connexions themselves are altogether so.

SECTION XIX.

Complex Ideas alone capable of that kind of Description which goes by the name of a Definition.

But now in definitions properly so called we first consider the term we use, as the sign of some inward conception, either annexed to it by custom, or our own free choice ; and then the business of the definition is to unfold and explicate that idea. As, therefore, the whole art lies in giving just and true copies of our ideas, a definition is then said to be perfect, when it serves distinctly to excites the idea described in the mind of another, even supposing him before wholly unacquainted with it. This point settled, let us next inquire into what those ideas are which are capable of being thus unfolded. And in the first place, it is evident that all our simple ideas are necessarily excluded. We have seen already, that experience alone is to be consulted here, insomuch, that if either the objects whence they are derived come not in our way, or the avenues appointed by nature for their reception are wanting, no description is sufficient to convey them into the mind. But where the understanding is already supplied with these original and primitive conceptions, as they may be united together in an infinity of different forms ; so may all their several combinations be distinctly laid open by enumerating the simple ideas con-concerned in the various collections, and tracing the order and manner in which they are linked one to another. Now these combinations of simple notices constitute what we call our complex notions; whence it is evident, that complex ideas, and those alone, admit of that kind of description which goes by the name of a definition.

SECTION XX.

When a complex idea may be said to be fully unfolded.

The business of definitions is now, I think, pretty plain. They are, as we have seen, pictures or representations of our ideas; and as these representations are then only possible, when the ideas themselves are complex; it is obvious to remark, that definitions cannot have place, but where we make use of terms, standing for such complex ideas. But perhaps the reader may still expect, that we should enter a little more particularly into the nature of a definition, describe its parts, and show by what rules it ought to proceed in order to the attainment of its proper end. To give, therefore, what satisfaction we are able upon this point, we must again call to mind, that the design of a definition is, so to unfold the idea answering to any term, as that it may be clearly and distinctly transferred into the mind of another. But now our complex ideas, which alone are capable of this kind of description, being, as we have said, nothing more than different combinations of simple ideas; we then know and comprehend them perfectly, when we know the several simple ideas of which they consist, and can so put them together in our minds, as is necessary towards the framing of that peculiar connexion, which gives every idea its distinct and proper appearance.

SECTION XXI.

Two Things required in a Definition: to enumerate the Ideas, and explain the Manner of their Combination.

Two things are, therefore, required in every definition. First, that all the original ideas, out of which the complex one is formed, be distinctly enumerated. Secondly, that the order and manner of combining them into one conception be clearly explained. Where a definition has these requisites, nothing is wanting to its perfection; because every one who reads it, and understands the terms, seeing at once what ideas he is to join together, and also in what manner, can at pleasure form in his own mind the complex conception answering to the term defined. Let us, for instance, suppose the word *square* to stand for that idea, by which we represent to ourselves a figure whose sides subtend quadrants of a circumscribed circle. The parts of this idea are the sides bounding the figure. These must be four in number, and all equal among themselves, because they are each to subtend a fourth part of the same circle. But besides these component parts, we must also take notice of the manner of putting them together, if we should exhibit the precise idea for which the word *square* here stands. For four equal right lines, any how joined, will not subtend quadrants of a circumscribed circle. A figure with this property, must have its sides standing also at right angles. Taking in, therefore, this last consideration, respecting the manner of combining the parts, the idea is fully described, and the definition thereby rendered complete. For a figure, bounded by four equal sides, joined together at right angles, has the property required; and is, moreover, the only right-lined figure to which that property belongs.

SECTION XXII.

How we are to proceed, to arrive at just and adequate Definitions.

And now, I imagine it will be obvious to every one in what manner we ought to proceed, in order to arrive at just and adequate definitions. First, we are to take an exact view of the idea to be described, trace it to its original principles, and mark the several simple perceptions that enter into the composition of it. Secondly, we are to consider the particular manner in which these elementary ideas are combined, in order to the forming of that precise conception, for which the term we make use of stands. When this is done, and the idea wholly unravelled, we have nothing more to do, than fairly transcribe the appearance it makes to our own minds. Such a description, by distinctly exhibiting the order and number of our primitive conceptions, cannot fail to excite, at the same time, in the mind of every one that reads it, the complex idea resulting from them; and therefore attains the true and proper end of a definition.

CHAP. VII.

OF THE COMPOSITION AND RESOLUTION OF OUR IDEAS, AND THE RULES OF DEFINITION THENCE ARISING.

SECTION I.

In compounding our Ideas, we proceed by successive Gradation.

The rule laid down in the foregoing chapter is general, extending to all possible cases; and is, indeed, that to which alone we can have recourse, where any doubt or difficulty arises. It is not, however, necessary that we should practice it in every particular instance. Many of our ideas are extremely complicated; insomuch that to enumerate all the simple perceptions out of which they are formed, would be a very troublesome and tedious work. For this reason, logicians have established certain compendious rules of defining, of which it may not be amiss here to give some account. But in order to the better understanding of what follows, it will be necessary to observe, that there is a certain gradation in the composition of our ideas. The mind of man is very limited in its views, and cannot take in a great number of objects at once. We are, therefore, fain to proceed by steps, and make our first advances subservient to those which follow. Thus in forming our complex notions, we begin at first with but a few simple ideas, such as we can manage with ease, and unite them together into one conception. When we are provided with a sufficient stock of these, and have, by habit and use, rendered them familiar to our minds, they become the component parts of other ideas, still more complicated, and form what we may call a second order of compound notions. This process, as is evident, may be continued to any degree of composition we please, mounting from one stage to another, and enlarging the number of combinations.

SECTION II.

Hence Ideas of this Class best comprehended, when we advance gradually through all the several Orders.

But now in a series of this kind, whoever would acquaint himself perfectly with the last and highest order of ideas, finds it much the most expeditious method to proceed gradually through all the intermediate steps. For was he to take any very compounded idea to pieces, and without regard to the several classes of simple perceptions, that have already been formed into distinct combinations, break in at once into its original principles, the number would be so great, as perfectly to confound the imagination, and overcome the utmost reach and capacity of the mind. When we see a prodigious multitude of men, jumbled together in crowds, without order, or any regular position, we find it impossible to arrive at an exact knowledge of their number. But if they are formed into separate battalions, and so stationed as to fall within the leisurely survey of the eye; by viewing them successively, and in order, we come to an easy and certain determination. It is the same in our complex ideas. When the original perceptions, out of which they are framed, are very numerous, it is not enough that we take a view of them in loose and scattered bodies.

We must form them into distinct classes, and unite these classes in a just and orderly manner, before we can arrive at a true knowledge of the compound notices resulting from them.

SECTION III.

Our Definitions ought to keep pace with our Ideas, and observe a like Gradation.

This gradual progress of the mind to its compound notions, through a variety of intermediate steps, plainly points out the manner of conducting the definitions by which these notions are conveyed into the minds of others. For as the series begins with simple and easy combinations, and advances through a succession of different orders, rising one above another in the degree of composition; it is evident, that in a train of definitions expressing these ideas, a like gradation is to be observed. Thus the complex ideas of the lowest order can no otherwise be described, than by enumerating the simple ideas out of which they are made, and explaining the manner of their union. But then in the second, or any succeeding order, as they are formed out of those gradual combinations, that constitute the inferior classes, it is not necessary, in describing them, to mention one by one, all the simple ideas of which they consist. They may be more distinctly and briefly unfolded, by enumerating the compound ideas of a lower order from whose union they result, and which are all supposed to be already known, in consequence of previous definitions. Here then it is, that the logical method of defining takes place; which, that we may the better understand, I shall explain somewhat more particularly, the several steps and gradations of the mind, in compounding its ideas, and thence deduce that peculiar form of a definition, which logicians have thought fit to establish.

SECTION IV.

The Steps by which the Mind proceeds from Particular to General Ideas.

All the ideas we receive, from the several objects of nature that surround us, represent distinct individuals. These individuals, when compared together, are found in certain particulars to resemble. Hence, by collecting the resembling particulars into one conception, we form the notion of a *species*. And here, let it be observed, that this last idea is less complicated than that by which we represent any of the particular objects contained under it. For the idea of the species excludes the peculiarities of the several individuals, and retains only such properties as are common to them all. Again, by comparing several species together, and observing their resemblance, we form the idea of the *genus;* where, in the same manner as before, the composition is lessened, because we leave out what is peculiar to the several species compared, and retain only the particulars wherein they agree. It is easy to conceive the mind, proceeding thus from one step to another, and advancing through its several classes of general notions, until at last it comes to the highest genus of all, denoted by the word *being*, where the bare idea of existence is only concerned.

SECTION V.

The conduct of the Mind in compounding its Ideas as it advances through the different Orders of Perception.

In this procedure, we see the mind unravelling a complex idea, and tracing it in the ascending scale, from greater to less degrees of composition, until it terminates in one simple perception. If now we take the series the contrary way, and beginning with the last or highest genus, carry our view downwards, through all the inferior genera and species, quite to the individuals, we shall thereby arrive at a distinct apprehension of the conduct of the understanding in compounding its ideas. For in the several classes of our perceptions, the highest in the scale is, for the most part, made up of but a few simple ideas, such as the mind can take in and survey with ease. This first general notion, when branched out into the different subdivisions contained under it, has in every one of them something peculiar, by which they are distinguished among themselves; insomuch, that in descending from the genus to the species, we always superadd some new idea, and thereby increase the degree of composition. Thus the idea denoted by the word *figure*, is of a very general nature, and composed of but few simple perceptions, as implying no more than space every where bounded. But if we descend farther, and consider the boundaries of this space, as, that they may be either lines or surfaces, we fall into the several species of figure. For where the space is bounded by one or more surfaces, we give it the name of a *solid figure*; but where the boundaries are lines, it is called a *plain figure.*

SECTION VI.

The Idea of the Species formed by superadding the specific Difference to the Genus.

In this view of things, it is evident, that the *species* are formed by superadding a new idea to the *genus.* Here, for instance, the genus is circumscribed space. If now to this we superadd the idea of a circumscription by line, we frame the notion of that species of figures which are called *plain;* but if we conceive the circumscription to be by surfaces, we have the species of *solid figures.* This superadded idea is called the *specific difference,* not only as it serves to divide the *species* from the *genus,* but because, being different in all the several subdivisions, we thereby also distinguish the *species* one from another. And as it is likewise that conception, which, by being joined to the general idea, completes the notion of the *species;* hence it is plain, that the *genus* and *specific difference* are to be considered as the proper and constituent parts of the *species*. If we trace the progress of the mind still farther, and observe it advancing through the inferior species, we shall find its manner of proceeding to be always the same. For every lower species is formed by superadding some new idea to the species next above it; insomuch, that in descending the scale of our perceptions, the understanding passes through different orders of complex notions, which become more and more complicated at every step it takes. Let us resume here, for instance, the species of plain figures. They imply no more than space bounded by lines. But if we take in an additional consideration of the nature of these lines, as whether they are *right* or *curves*, we fall into the subdivisions of plain figure, distinguished by the names *rectilinear*, *curvilinear*, and *mixtilinear*.

SECTION VII.

And in all the inferior Species by superadding the specific to the nearest Genus.

And here we are to observe, that though plain figures, when considered as one of those branches that come under the notion of figure in general, take the name of a species; yet compared with the classes of curvilinear, rectilinear, and mixtilinear, into which they themselves may be divided, they really become a genus, of which the before mentioned subdivisions constitute the several species. These species, in the same manner as in the case of plain and solid figures, consist of the genus and specific difference, at their constituent parts. For in the *curvilinear* kind, the *curvity* of the lines bounding the figure, makes what is called the *specific difference;* to which if we join the genus, which here is plain figure, or space circumscribed by lines, we have all that is necessary towards completing the notion of the species. We are only to take notice, that this last subdivision, having two genera above it, *viz. plain figure* and *figure in general;* the genus joined with the specific difference, in order to constitute the species of *curvilinear*, is that which lies nearest to the said species. It is the notion of *plain figure*, and not of *figure in general*, that, joined with the idea of *curvity*, makes up the complex conception of *curved-lined figures*. For in this descending scale of our ideas—*Figure in general*, *plain figures*, *curve-lined figures*—the two first are considered as genera in respect to the third: and the second in order, or that which stands next to the third, is called the *nearest genus*. But now as it is this second idea, which, joined with the notion of *curvity*, forms the species of *curve-lined figures*; it is plain, that the third or last idea in the series, is made up of the *nearest genus* and *specific difference*. This rule holds invariably, however far the series is continued; because in a train of ideas thus succeeding one another, all that precede the last are considered as so many genera, in respect of that last; and the last itself is always formed by superadding the specific difference to the genus next it.

SECTION VIII.

The Idea of an individual composed of the lowest Species and numeric Difference.

Here then we have an universal description, applicable to all our ideas, of whatever kind, from the highest genus to the lowest species. For taking them in order downwards from the said general idea, they every where consist of the *genus proximum*, and *differentia specifica*, as logicians love to express themselves. But when we come to the lowest species of all, comprehending in it only individuals, the superadded idea, by which these individuals, are distinguished one from another, no longer takes the name of the specific difference. For here it serves not to denote distinct species, but merely a variety of individuals, each of which, having a particular existence of its own, is therefore *numerical different* from every other of the same kind. And hence it is, that in this last case, logicians choose to call the superadded idea by the name of the *numerically difference*; insomuch that as the idea of a species is made up of the *nearest genus* and *specific difference*, so the idea of an individual consists of the *lowest species* and *numeric difference.* Thus the circle is a species of curve-lined figures, and what we call the *lowest species*, as comprehending under it only individuals. Circles in particular are distinguished from one another by the length and position of their diameters. The length therefore and position of the diameter of a circle is what logicians call the *numerical difference ;* because these being given, the circle itself may be described, and an individual thereby constituted.

SECTION IX.

Definitions to follow one another in Train, and pass through the same successive Gradations as our Compound Ideas.

And thus we have endeavoured to trace, in the best manner we are able, the progress of the mind in compounding its ideas. It begins, we see, with the most general notions, which, consisting of but a few simple notices, are easily combined and brought together into one conception. Thence it proceeds to the species comprehended under this general idea, and these are formed by joining together the *genus* and *specific difference.* And as it often happens, that these species may be still further subdivided, and run on in a long series of continued gradations, producing various orders of compound perceptions ; so all these several orders are regularly and successively formed, by annexing in every step the *specific difference* to the *nearest genus.* When by this method of procedure, we are come to the lowest order of all, by joining the *species* and *numeric difference*, we frame the ideas of individuals. And here the series necessarily terminates, because it is impossible any farther to bound or limit our conceptions. This view of the composition of our ideas, representing their constituent parts in every step of the progression, naturally points out the true and genuine form of a definition. For as definitions are no more than the descriptions of the ideas for which the terms defined stand; and as ideas are then described, when we enumerate distinctly, and in order, the parts of which they consist; it is plain, that by making our definitions follow one another, according to the natural train of our conceptions, they will be subject to the same rules, and keep pace with the ideas they describe.

SECTION X.

The form of a Definition in all the various orders of Conception.

As therefore the first order of our compound notions, or the ideas that constitute the highest genera, in the different scales of perception, are formed by uniting together a certain number of simple notices, so the terms expressing these genera, are defined *by enumerating the simple notices so combined.* And as the species comprehended under any genus, or the complex ideas of the second order, arise from superadding the specific difference to the said general idea; so the definition of the names of the species is absolved, *in a detail of the ideas of the specific difference, connected with the term of the genus.* For the *genus* having been before defined, the term by which it is expressed stands for a known idea, and may therefore be introduced into all subsequent definitions, in the same manner as the names of simple perceptions. It will now, I think, be sufficiently obvious, that the definitions of all the succeeding orders of compound notions, will every where consist *of the term of the nearest genus joined with an enumeration of the ideas that constitute the specific difference;* and that the definition of individuals *unites the name of the lowest species, with the terms by which we express the ideas of the numeric difference.*

SECTION XI.

The logical Method of defining perfect in its Kind ;

Here then we have the true and proper form of a definition, in all the various orders of conception. This is that method of defining, which is commonly called *logical*, and which, we see, is perfect in its kind, inasmuch as it presents a full and adequate description of the idea, for which the term defined stands. There are still two things worthy of observation, before we take leave of this subject. First, that the very frame and contexture of these definitions, points out the order in which they ought to follow one another. For as the name of the genus is admitted into a description, only in consequence of its having been before defined; it is evident, that we must pass gradually through all the different orders of conception. Accordingly, logicians lay it down as a rule, that we are to begin always with the highest genus, and carry on the series of definitions regularly through all the intermediate genera and species, quite down to the individuals. By this means our descriptions keep pace with our ideas, and pass through the same successive gradations; insomuch that the perusal of them must excite those ideas in the understanding of another, in the very order and manner in which they are put together by the mind, in its uniform advances from simple to the most complicated notions. Now this is the true and proper end of defining, and indeed the highest perfection of that art.

SECTION XII.

And applicable to all Words whatsoever capable of a Definition.

There is yet another thing to be observed on this head, namely, that the form here prescribed, is applicable to all words whatsoever, capable of a definition. For as every term we use, must denote some idea, either general or particular; and as all our complex notions relating to both these classes of perception, from the highest genus quite down to the individuals, come within the rules of description here given; it is evident, that this particular manner of unfolding an idea, may be extended to all the possible complex conceptions we can connect with our words. By the rules therefore of this method, definitions may be applied to all terms standing for complex ideas; and as these, by what we have shown at large in the two foregoing chapters, are the only definable articles of speech; it necessarily follows, that the directions here given are universal, extended to all particular instances, and are alike applicable in all languages. And thus, at length, we have not only deduced that peculiar form of a definition which obtains among logicians, but shown it also to be perfect in its kind, and to take in the whole compass of language.

BOOK II.

Of Judgment, or Intuition.

CHAP. I.

OF THE GROUNDS OF HUMAN JUDGMENT.

SECTION I.

Intuition respects the relation between our Ideas when they are immediately perceivable.

When the mind is furnished with ideas, its next step in the way to knowledge is, the comparing these ideas together, in order to judge of their agreement or disagreement. In this joint view of our ideas, if the relation is such, as to be immediately discoverable by the bare inspection of the mind; the judgments thence obtained are called *intuitive*, from a word that denotes *to look at*: for in this case, a mere attention to the ideas compared, suffices to let us see, how far they are connected or disjoined. Thus, *that the whole is greater than any of its parts*, is an intuitive judgment, nothing more being required to convince us of its truth, than an attention to the ideas of *whole* and *part*. And this, too, is the reason, why we call the act of the mind forming these judgments *intuition*; as it is indeed no more than an immediate perception of the agreement or disagreement of any two ideas.

SECTION II.

Experience and Testimony the Ground of judging as to Facts.

But here it is to be observed, that our knowledge of this kind respects only our ideas, and the relations between them, and therefore can serve only as a foundation to such reasonings, as are employed in investigating these relations. Now it so happens, that many of our judgments are conversant about facts, and the real existence of things, which cannot be traced by the bare contemplation of our ideas. It does not follow, because I have the idea of a circle in my mind, that therefore a figure answering to that idea has a real existence in nature. I can form to myself the notion of a centaur, or golden mountain, but never imagine on that account that either of them exists. What then are the grounds of our judgments, in relation to facts? I answer these two, *experience* and *testimony*. By *experience* we are informed of the existence of the several objects which surround us, and operate upon our senses. *Testimony* is of a wider extent, and reaches not only to objects beyond the present sphere of our observation, but also to facts and transactions, which, being now past, and having no longer any existence, could not, without this conveyance, have fallen under our cognizance.

SECTION III.

Three Foundations of human Judgment; viz. 1. *Intuition the Ground of scientifical Knowledge:*

Here then we have three foundations of human judgment, from which the whole system of our knowledge may with ease and advantage be deduced. First, *intuition*, which respects our ideas themselves, and their relations, and is the foundation of that species of reasoning which we call *demonstration*. For whatever is deduced from our intuitive perceptions, by a clear and connected series of proofs, is said to be demonstrated, and produces absolute certainty in the mind. Hence the knowledge obtained in this manner, is what we properly term *science;* because, in every step of the procedure, it carries its own evidence along with it, and leaves no room for doubt or hesitation. And what is highly worthy of notice, as the truths of this class express the relations between our ideas, and the same relations must ever and invariably subsist between the same ideas, our deductions in the way of science constitute what we call eternal, necessary, and immutable truths. If it be true, that the whole is equal to all its parts, it must be so unchangeably; because the relations of equality being attached to the ideas themselves, must ever intervene where the same ideas are compared. Of this nature are all the truths of natural religion, morality and mathematics; and in general whatever may be gathered from the bare view and consideration of our ideas.

SECTION IV.

2. *Experience the Ground of our Knowledge of the Powers and Qualities of bodies.*

The sceond ground of human judgment is *experience;* from which we infer the existence of those objects that surround us, and fall under the immediate notice of our senses. When we see the sun, or cast our eyes towards a building, we not only have ideas of these objects within ourselves, but ascribe to them a real existence out of the mind. It is also by the information of the senses, that we judge of the qualities of bodies; as when we say that snow is white, fire hot, or, steel, hard. For as we are wholly unacquainted with the internal structure and constitution of the bodies that produce these sensations in us, nay, and are unable to trace any connection between that structure and the sensations themselves, it is evident that we build our judgments altogether upon observation, ascribing to bodies such qualities as are answerable to the perceptions they excite in us. But this is not the only advantage derived from experience, for to that, too, are we indebted for all our knowledge regarding the co-existence of sensible qualities in objects, and the operations of bodies one upon another. Ivory, for instance, is hard and elastic; this we know by experience, and indeed by that alone. For being altogether strangers to the true nature both of elasticity and hardness, we cannot, by the bare contemplation of our ideas, determine how far the one necessarily implies the other, or whether there may not be a repugnance between them. But when we observe them to exist both in the same object, we are then assured from experience that they are not incompatible; and when we also find, that a stone is hard and not elastic—and that air, though elastic, is not hard, we also conclude, upon the same foundation, that the ideas are not necessarily conjoined, but may exist separately in different objects. In like manner, with regard to the operations of bodies, one upon another, it is evident, that our knowedge this way is all derived from observation. *Aqua regia* dissolves gold, as has been found by frequent trial; nor is there any other way of arriving at the discovery. Naturalists may tell us, if they please, that the parts of *aqua regia* are of a texture apt to insinuate between the corpuscles of gold, and thereby loosen and shake them asunder. If this is a true account of the matter, I believe it will, notwithstanding, be allowed, that our conjecture, in regard to the conformation of these bodies, is deduced from the experiment, and not the experiment from the conjecture. It was not from any previous knowledge of the intimate structure of *aqua regia* and *gold*, and the aptness of their parts to act or be acted upon, that we came by the conclusion above mentioned. The internal constitution of bodies is in a manner wholly unknown to us; and could we even surmount this difficulty, yet as the separation of the parts of gold implies something like an active force in the *menstruum*, and we are unable to conceive how it comes to be possessed of this activity; the effect must be owned to be altogether beyond our comprehension. But when repeated trials had once confirmed it, insomuch that it was admitted as an established truth in natural knowledge, it was then easy for men to spin out theories of their own invention, and contrive such a structure of parts, both for *gold* and *aqua regia*, as would best serve to explain the phenomenon, upon the principles of that system of philosophy they had adopted. I might easily show from innumerable other instances, how much our knowledge of the mutual action of bodies depends upon observation. The bite of a viper will kill. Plants are some salutary, others noxious. Fire dissolves one body, and hardens another. These are truths generally known; nor is it less evident that we owe their discovery wholly to experience.

SECTION V.

Why many useful Inventions owe their Birth to Chance.

And hence it is easy to account for what to some writers has appeared a very great paradox; that many of the most important inventions in human life have taken their rise from chance, and instead of coming out of the schools of philosophers, are for the most ascribed to men of no figure in the commonwealth of learning. Sowing, planting, the use of compass, and such like, are not deductions of human reason, but discoveries which owe their birth to observation and trial. No wonder, therefore, if these inventions derived their beginning from such, as, being engaged in the active and busy scenes of life, were more in the way of those experiments which lead to discoveries of this nature. And here, as the particular callings and professions of men, and oft-times chance, has a great ascendant, it need not seem strange, if some of the most useful arts in society appear to have had an original purely casual.

SECTION VI.

Natural Knowledge, from the grounds on which it rests aptly termed experimental Philosophy.

From what has been said, it is evident, that as intuition is the foundation of what we call *scientifical* knowledge, so is experience of *natural.* For this last being wholly taken up with the objects of sense, or those bodies that constitute the natural world—and their properties, as far as we can discover them, being to be traced only by a long and painful series of observations; it is apparent, that in order to improve this branch of knowledge, we must betake ourselves to the method of trial and experiment. Accordingly, we find, that while this was neglected, little advance was made in the philosophy of nature; whereas a contrary proceeding has enriched the present age with many valuable discoveries; insomuch that natural knowledge, in allusion to the foundation on which it stands, has been very aptly called *experimental philosophy*.

SECTION VII.

Though much of our Knowledge of Body depends on Testimony, yet Experience is the ultimate Foundation of it.

But though experience is what we may term the immediate foundation of natural knowledge, yet with respect to particular persons, its influence is very narrow and confined. The bodies that surround us are numerous; many of them lie at a great distance, and some quite beyond our reach. Life too is short, and so crowded with cares, that but little time is left for any single man to employ himself in unfolding the mysteries of nature. Hence it is necessary to admit many things upon the testimony of others, which by this means becomes the foundation of a great part of our knowledge of body. No man doubts of the power of *aqua regia* to dissolve gold, though perhaps he never himself made the experiment. In these, therefore, and such like cases, we judge of the facts and operations of nature, upon the mere ground of testimony. However, as we can always have recourse to experience, where any doubt or scruple arises, this is justly considered as the true foundation of natural philosophy, being indeed the ultimate support upon which our assent rests, and whereto we appeal, when the highest degree of evidence is required.

SECTION VIII.

3. *Testimony the Ground of Historical Knowledge.*

But there are many facts that will not allow of an appeal to the senses, and in this case testimony is the true and only foundation of our judgments. All human actions, of whatever kind, when considered as already past, are of the nature here described; because having now no longer any existence, both the facts themselves, and the circumstances attending them, can be known only from the relations of such as had sufficient opportunities of arriving at the truth. *Testimony*, therefore, is justly accounted a third ground of human judgment: and as from the other two we have deduced *scientifical* and *natural* knowledge, so may we from this derive *historical;* by which I would be understood to mean, not merely a knowledge of the civil transactions of states and kingdoms, but of all facts whatsoever, where testimony is the ultimate foundation of our belief.

SECTION IX.

The second Operation of the Mind, commonly extended beyond Intuition.

Before I conclude this chapter, it will be necessary to observe, that though the second operation of the mind, properly speaking extends not beyond intuitive perceptions, yet logicians have not confined themselves to so strict a view of it; but calling it by the name *judgment*, thereby denote all acts of the mind, where only two ideas are compared, without the immediate interposition of a third. For when the mind joins or separates two ideas, though perhaps this is done in consequence of a train of previous reasoning, yet if the understanding proceeds upon established notions, without attention to that train of reasoning, its determinations are still considered as acts of judgment. Thus, *That God created the universe*, that *men are accountable for their actions*, are frequently mentioned by logicians, as instances of the mind judging. And yet it is apparent, that these judgments are by no means of the kind we call intuitive; nay, that it requires much exercise of the reasoning faculty, before a man can trace their connexion with the perceptions of that name. I ould in the same manner easily show, that even our judgments of experience and testimony, when pursued to their source, derive all their power of persuasion, from being linked with intuitive truths. But I shall wave this inquiry for the present, as being of a nature too subtile for a work of this kind. The remark itself, however, was needful, as well to illustrate the proper distinction between the powers of the understanding, as to explain the reason why, in this part of logic, we extend the second operation of the mind beyond those limits, that in strictness of speech belong to it. Let us now proceed to consider a little more particularly the nature and variety of these our judgments.

CHAP. II.

OF AFFIRMATIVE AND NEGATIVE PROPOSITIONS.

SECTION I.

The Subject and Predicate of a Proposition explained.

WHILE the comparing of our ideas is considered merely as an act of the mind, assembling them together, and joining or disjoining them, according to the result of its perceptions, we call it *judgment;* but when our judgments are put into words, they then bear the name of *propositions.* A proposition, therefore, is a sentence expressing some judgment of the mind, whereby two or more ideas are affirmed to agree or disagree. Now, as our judgments include at least two ideas, one of which is affirmed or denied of the other, so must a proposition have terms answering to these ideas. The idea of which we affirm or deny, and of course the term expressing that idea, is called the *subject* of the proposition. The idea affirmed or denied, as also the term answering it, is called the *predicate*. Thus in the proposition, *God is omnipotent: God* is the subject, it being of him that we affirm omnipotence; and *omnipotence* is the predicate, because we affirm the idea, expressed by that word, to belong to God.

SECTION II.

The Copula, &c.

But as in propositions, ideas are either joined or disjoined; it is not enough to have terms expressing those ideas, unless we have also some words to denote their agreement or disagreement. That word in a proposition, which connects two ideas together, is called the *copula;* and if a negative particle be annexed, we thereby understand, that the ideas are disjoined. *The substantive verb* is commonly made use of for the copula, as in the above mentioned proposition, *God is omnipotent;* where it represents the copula, and signifies the agreement of the ideas *God* and *omnipotence*. But if we mean to separate two ideas, then, besides the substantive verb, we must also use some particle of negation, to express this repugnance. The proposition, *man is not perfect,* may serve as an example of this kind, where the notion of *perfection* being removed from the idea of *man,* the negative particle, *not,* is inserted after the copula, to signify the disagreement between the subject and predicate.

SECTION III.

Propositions sometimes expressed by a single Word.

Every proposition necessarily consists of these three parts, but then it is not alike needful, that they be all severally expressed in words; because the copula is often included in the term of the predicate; as when we say, *he sits;* which imports the same as *he is sitting.* In the

Latin language, a single word has often the force of a whole sentence. Thus *ambulat* is the same as *ille est ambulans; amo*, as *ego sum amans;* and so in innumerable other instances; by which it appears, that we are not so much to regard the number of words in a sentence, as the ideas they represent, and the manner in which they are put together. For whenever two ideas are joined or disjoined in an expression, though of but a single word, it is evident, that we have a subject, predicate, and copula, and of consequence a complete proposition.

SECTION IV.

Affirmative and Negative Propositions.

When the mind joins two ideas, we call it an *affirmative* judgment; when it separates them, a *negative;* and as any two ideas compared together must necessarily either agree or not agree, it is evident that all our judgments fall under these two divisions. Hence, likewise, the proposition expressing these judgments are all either affirmative or negative. An affirmative proposition connects the predicate with the subject, as, *a stone is heavy;* a negative proposition separates them, as, *God is not the author of evil. Affirmation*, therefore, is the same as joining two ideas together, and this is done by means of the copula. *Negation*, on the contrary, marks a repugnance between the ideas compared; in which case a negative particle must be called in, to show that the connexion included in the copula does not take place.

SECTION V.

When the negative particle serves to disjoin Ideas.

And hence we see the reason of the rule commonly laid down by logicians, that in all negative propositions, the negation ought to affect the copula. For as the copula, when placed by itself, between the subject and the predicate, manifestly binds them together; it is evident, that in order to render a proposition negative, the particle of negation must enter it in such manner as to destroy this union. In a word, then only are two ideas disjoined in a proposition, when the negative particle may be so referred to the copula, as to break the affirmation included in it, and undo that connexion it would otherwise establish. When we say, for instance, *no man is perfect ;* take away the negation, and the copula of itself plainly unites the ideas in the proposition. But as this is the very reverse of what is intended, a negative mark is added, to show that this union does not here take place. The negation, therefore, by destroying the effect of the copula, changes the very nature of the proposition, insomuch that instead of binding two ideas together, it denotes their separation. On the contrary, in this sentence, *the man who departs not from an upright behaviour, is beloved of God ;* the predicate *beloved of God*, is evidently affirmed of the subject, *an upright man ;* so that, notwithstanding the negative particle, the proposition is still affirmative. The reason is plain; the negation here affects not the copula, but making properly a part of the subject, serves, with other terms in the sentence, to form one complex idea, of which the predicate, *beloved of God*, is directly affirmed. This, perhaps, to some may appear a mere logical refinement, contrived to justify the scholastic rule for distinguishing between affirmative and negative propositions. But if it be considered, that this distinction is of great importance in reasoning, and cannot, in many cases, be made with certainty, but by means of this criterion here given, the reader will see sufficient reason for my taking so much pains to illustrate it.

SECTION VI.

How a Copula comes to be a Part of a negative Proposition.

Perhaps it may still appear a mystery, how a copula can be said to be a part of a negative proposition, whose proper business it is to disjoin ideas. This difficulty, however, will vanish, if we call to mind, that every judgment implies a direct affirmation, and that this affirmation alone makes the true copula in a proposition. But as our affirmations are of two kinds, viz. either of agreement or of disagreement between the ideas compared; hence there is also a twofold expression of our judgments. In the case of agreement, the copula alone suffices because it is the proper mark whereby we denote an identity or conjunction of ideas. But where perceptions disagree, there we must call in a negative particle: and this gives us to understand that the affirmation implied in the copula, is not of any connexion between the subject and predicate, but of their mutual opposition and repugnance.

CHAP. III.

OF UNIVERSAL AND PARTICULAR PROPOSITIONS.

SECTION I.

Division of Propositions into Universal and Particular.

The next considerable division of propositions, is into *universal* and *particular*. Our ideas, according to what has been already observed in the first part, are all singular, as they enter the mind, and represent individual objects. But as by abstraction we can render them universal, so as to comprehend a whole class of things, and sometimes several classes at once; hence the terms expressing these ideas must be in like manner universal. If, therefore, we suppose any general term to become the subject of a proposition, it is evident, that whatever is affirmed of the abstract idea belonging to that term, may be affirmed of all the individuals to which that idea extends. Thus when we say, *men are mortal;* we consider mortality, not as confined to one or any number of particular men, but as what may be affirmed without restriction of the whole species. By this means, the proposition becomes as general as the idea which makes the subject of it, and indeed derives its universality entirely from that idea, being more or less so, according as this may be extended to more or fewer individuals. But it is further to be observed of these general terms, that they sometimes enter a proposition in their full latitude, as in the example given above; and sometimes appear with a mark of limitation. In this last case, we are given to understand, that the predicate agrees not to the whole universal idea, but only to a part of it; as in the proposition, *some men are wise*; for here wisdom is not affirmed of every particular man, but restrained to a few of the human species.

SECTION II.

Propositions universal where the Subject is so, without a Mark of Restriction.

Now from this different appearance of the general idea, that constitutes the subject of any judgment, arises the division of propositions into *universal* and *particular.* An *universal* proposition, is that wherein the subject is some general term, taken in its full latitude, insomuch that the predicate agrees to all the individuals comprehended under it, if it denotes a proper species; and to all the several species and their individuals, if it marks an idea of a higher order. The words *all*, *every*, *no*, *none*, &c. are the proper signs of this universality; and as they seldom fail to accompany general truths, so they are the most obvious criterion whereby to distinguish them. *All animals have a power of beginning motion.* This is an universal proposition; as we know from the word *all*, prefixed to the subject *animal*, which denotes that it must be taken in its full extent. Hence the power of beginning motion may be affirmed of all the several species of animals; as of birds, quadrupeds, insects, fishes, &c. and of all the individuals of which these different classes consist, as of this hawk, that horse, and so for others.

SECTION III.

Propositions particular where some universal Subjects appear with a Mark of Limitation.

A *particular* proposition has in like manner some general term for its subject, but with a mark of limitation added, to denote, that the predicate agrees only to some of the individuals comprehended under a species, or to one or more of the species belonging to any genus, and not to the whole universal idea. Thus, *some stones are heavier than iron; some men have an uncommon share of prudence.* In the last of these propositions, the subject, *some men*, implies only a certain number of individuals, comprehended under a single species. In the former, where the subject is a genus, that extends to a great variety of distinct classes, *some stones* may not only imply any number of particular stones, but also several whole species of stones; inasmuch as there may be not a few, with the property there described. Hence we see that a proposition does not cease to be particular, by the predicates agreeing to a whole species, unless that species, singly and distinctly considered, makes also the subject of which we affirm or deny. For if it belongs to some genus, that has other speceis under it, to which the predicate does not agree; it is plain, that where this genus is that of which we affirm or deny, the predicate agreeing only to a part of it, and not to the whole general idea, constitutes the proposition particular.

SECTION IV.

A sure and infallible Criterion whereby to distinguish between universal and particular Propositions.

Here then we have a sure and infallible mark, whereby to distinguish between universal and particular propositions. Where the predicate agrees to all the individuals comprehended under the notion of the subject, there the proposition is universal; where it belongs only to some of them, or to some of the species of the general idea, there the proposition is particular. This criterion is of easy application, and much safer than to depend upon the common signs of *all*, *every*, *some*, *none* &c. because these being different in different languages, and often varying in their signification, are very apt in many cases to mislead the judgment. Thus if we say, *all the soldiers when drawn up, formed a square of a hundred men a side:* it is evident that the predicate cannot be affirmed of the several individuals, but of the whole collective idea of the subject; whence, by the rule given above, the proposition is not universal. It is true, logicians lay down many observations, to enable us to distinguish aright on this head: but if the criterion here given be duly attended to, it will be of more real service to us than an hundred rules. For it is infallible, and may be applied with ease; whereas the directions, which we meet with in treatises of logic, being drawn for the most part from the analogy of language, and common forms of speech are not only burdensome to the memory, but often very doubtful and uncertain in their application.

SECTION V.

Singular Propositions contained under the Head of Particulars.

There is still one species of propositions that remains to be described; and which the more deserves our notice, as it is not yet agreed among logicians, to which of the two classes mentioned above, they ought to be referred. I mean *singular* propositions; or those where the subject is an individual. Of this nature are the following: *Sir Isaac Newton was the inventor of fluxions; this book contains many useful truths.* What occasions some difficulty as to the proper rank of these propositions, is, that the subject being taken according to the whole of its extension, they sometimes have the same effect in reasoning, as universals. But if it be considered, that they are in truth, the most limited kind of particular propositions and that no proposition can, with any propriety, be called universal, but where the subject is some universal idea ; we shall not be long in determining to which class they ought to be referred. When we say, *some books contain useful truths*, the proposition is particular ; because the general term appears with a mark of restriction. If, therefore, we say, *this book contains useful truths ;* it is evident, that the proposition must be still more particular, as the limitation, implied in the word *this*, is of a more confined nature, than in the former case. I know there are instances, where singular propositions have the same effect in reasoning, as universals, yet is not this, by reason of any proper universality, belonging to them ; but because the conclusion, in such cases being always singular, may be proved by a middle term which is also singular ; as I could easily demonstrate, were this a proper place for entering into a discussion of that nature.

SECTION VI.

The fourfold Division of Propositions.

We see, therefore, that all propositions are either *affirmative* or *negative ;* nor is it less evident, that in both cases, they be *universal* or *particular.* Hence arises that celebrated fourfold division of them, into *universal affirmative*, and *universal negative ; particular affirmative*, and *particular negative ;* which comprehends, indeed, all their varieties. The use of this method of distinguishing them will appear more fully afterwards, when we come to treat of reasoning and syllogism.

CHAP. IV.

OF ABSOLUTE AND CONDITIONAL PROPOSITIONS.

SECTION I.

Distinction of Qualities into Essential and Accidental.

THE objects about which we are chiefly conversant in this world, are all of a nature liable to change. What may be affirmed of them at one time cannot often at another; and it makes no small part of our knowledge to distinguish rightly these variations, and trace the reasons upon which they depend. For it is observable, that amidst all the vicissitudes of nature, some things remain constant and invariable; nor are even the changes to which we see others liable, effected, but in consequence of uniform and steady laws, which, when known, are sufficient to direct us in our judgments about them. Hence philosophers, in distinguishing the objects of our perception into various classes, have been very careful to note, that some properties belong essentially to the general idea, so as not to be separable from it but by destroying its very nature; while others are only accidental, and may be affirmed or denied of it, in different circumstances. Thus, solidity, a yellow colour, and great weight, are considered as essential qualities of gold; but whether it shall exist as an uniform, conjoined mass, is not alike necessary. We see that by a proper menstruum, it may be reduced to a fine powder, and that intense heat will bring it into a state of fusion.

SECTION II.

Hence a considerable Diversity in our Manner of judging.

Now, from this diversity in the several qualities of things, arises a considerable difference as to the manner of our judging about them. For in this first place, all such properties, as are inseparable from objects when considered as belonging to any genus or species, are affirmed absolutely and without reserve of that general idea. Thus we say, *gold is very weighty ; a stone is hard ; animals have a power of self-motion.* But in the case of mutable or accidental qualities, as they depend upon some other consideration, distinct from the general idea ; that also must be taken into the account, in order to form an accurate judgment. Should we affirm, for instance, of some stones, that they are very susceptible of a rolling motion ; the proposition while it remains in this general form, cannot with any advantage be introduced into our reasonings. An aptness to receive that mode of motion flows from the figure of the stone ; which, as it may vary infinitely, our judgment then only becomes applicable and determinate, when the particular figure, of which volubility is a consequence, is also taken into the account. Let us then bring in this other consideration, and the proposition will run as follows : *stones of a spherical form are easily put into a rolling motion.* Here we see the condition upon which the predicate is affirmed, and therefore know in what particular cases the proposition may be applied.

SECTION III.

Which gives rise to the division of Propositions into Absolute and Conditional.

This consideration of propositions respecting the manner in which the predicate is affirmed of the subject, gives rise to the division of them into *absolute* and *conditional. Absolute* propositions are those, wherein we affirm some property inseparable from the idea of the subject, and which, therefore, belongs to it in all possible cases ; as, *God is infinitely wise ; virtue tends to the ultimate happiness of man.* But where the predicate is not necessarily connected with the idea of the subject, unless upon some consideration distinct from that idea, there the proposition is called *conditional.* The reason of the name is taken from the supposition annexed, which is of the nature of a condition, and may be expressed as such. Thus; *if a stone is exposed to the rays of the sun, it will contract some degree of heat. If a river runs in a very declining channel, its rapidity will constantly increase.*

SECTION IV.

The great Importance of this Division, as it renders Propositions determinate ;

There is not any thing of greater importance in philosophy, than a due attention to this division of propositions. If we are careful never to affirm things absolutely, but where the ideas are inseparably conjoined ; and if, in our other judgments, we distinctly mark the conditions which determine the predicate to belong to the subject ; we shall be the less liable to mistake, in applying general truths to the particular concerns of human life. It is owing to the exact observance of this rule, that mathematicians have been so happy in their discoveries ; and that what they demonstrate of magnitude in general, may be applied with ease in all obvious occurrences.

SECTION V.

And reduces them from Particulars to Generals.

The truth of it is, particular propositions are then known to be true, when we can trace their connexion with universals: and it is, accordingly, the great business of science to find out general truths, that may be applied with safety in all obvious instances. Now the great advantage arising from determining with care the conditions upon which one idea may be affirmed or denied of another, is this; that thereby particular propositions really become universal, may be introduced with certainty into our reasonings, and serve as standards to conduct and regulate our judgments. To illustrate this by a familiar instance: if we say, *some water acts very forcibly;* the proposition is particular: and as the conditions, on which this forcible action depends, are not mentioned, it is as yet uncertain in what cases it may be applied. Let us then supply these conditions, and the proposition will run thus; *water conveyed in sufficient quantity along a steep descent, acts very forcibly.* Here we have an universal judgment, inasmuch as the predicate, *forcible action*, may be ascribed to all water under the circumstances mentioned. Nor is it less evident, that the proposition in this new form is of easy application: and in fact we find, that men do apply it in instances where the forcible action of water is required; as in corn-mills, and many other works of art. Thus we see in what manner we are to proceed in order to arrive at universal truths, which is the great end and aim of science. And indeed, would men take the same care, duly to express the conditions on which they affirm and deny, as mathematicians do, in those theorems which they term hypothetical, I doubt not, but we might be able to deduce many truths in other parts of philosophy, with no less clearness, force and perspicuity, than has hitherto been thought peculiar to the science of quantity.

CHAP. V.

OF SIMPLE AND COMPOUND PROPOSITIONS.

SECTION I.

Division of Propositions into Simple and Compound.

HITHERTO we have treated propositions, where only two ideas are compared together. These are, in the general, called *simple;* because, having but one subject and one predicate, they are the effect of a simple judgment that admits of no subdivision. But if it so happens, that several ideas offer themselves to our thoughts at once, whereby we are led to affirm the same thing of different objects, or different things of the same object; the propositions, expressing these judgments, are called *compound:* because they may be resolved into as many others as there are subjects or predicates in the whole complex determination of the mind. Thus, *God is infinitely wise and infinitely powerful;* here there are two predicates, *infinite wisdom, and infinite power*, both affirmed of the same subject; and accordingly, the proposition may be resolved into two others, affirming these predicates severally. In like manner, in the proposition, *neither kings nor people are exempt from death*, the predicate is denied of both subjects, and may therefore be separated from them, in distinct propositions. Nor is it less evident, that if a complex judgment consists of several subjects and predicates, it may be resolved into as many simple propositions as are the number of different ideas compared together. *Riches and honours are apt to elate the mind, and increase the number of our desires.* In this judgment there are two subjects and two predicates: and it is at the same time apparent, that it may be resolved into four distinct propositions. *Riches are apt to elate the mind. Riches are apt to increase the number of our desires.* And so of honours.

SECTION II.

The proper Notion of a Compound Proposition ascertained.

Logicians have divided these compound propositions into a great many different classes; but in my opinion, not with a due regard to their proper definition. Thus *conditionals, casuals, relatives, &c.* are mentioned as so many distinct species of this kind, though in fact they are no more than simple propositions. To give an instance of a conditional: *If a stone is exposed to the rays of the sun, it will contract some degree of heat.* Here we have but one subject and one predicate; for the complex expression, *a stone exposed to the rays of the sun*, constitutes the proper subject of this proposition, and is no more than one determinate idea. The same thing happens in casuals. Rehoboam *was unhappy, because he followed evil counsel.* I deny not, that there is here an appearance of two propositions arising from the complexity of the expression; but when we come to consider the matter more nearly, it is evident that we have but a single subject and predicate. *The pursuit of evil counsel brought misery upon* Rehoboam. It is not enough, therefore, to render a proposition compound, that the subject and predicate are complex notions, requiring sometimes a whole sentence to express them: for in this case, the comparison is still confined to two ideas, and constitutes what we call a simple judgment. But where there are several subjects or predicates, or both, as the affirmation or negation may be alike extended to them all, the proposition, expressing such a judgment, is truly a collection of as many simple ones, as there are different ideas compared. Confining ourselves, therefore, to this more strict and just notion of compound propositions, they are all reducible to two kinds, *viz. copulatives and disjunctives.*

SECTION III.

Compound Propositions either Copulative,

A *copulative* proposition is, where the subjects and predicates are so linked together, that they may be all severally affirmed or denied one of another. Of this nature are the examples of compound propositions given above. *Riches and honours are apt to elate the mind, and increase the number of our desires. Neither kings nor people are exempt from death.* In the first of these, two predicates may be affirmed severally of each subject, whence we have four distinct propositions. The other furnishes an example of the negative kind, where the same predicate being disjoined from both subjects, may be also denied of them in separate propositions.

SECTION IV.

Or Disjunctive.

The other species of compound propositions are those called disjunctives; in which, comparing several predicates with the same subject, we affirm, that one of them necessarily belongs to it, but leave the particular predicate undetermined. If any one for example, says: *This world either exists of itself, or is the work of some all-wise and powerful cause;* it is evident, that one of the two predicates must belong to the world; but as the proposition determines not which, it is therefore of the kind we call *disjunctive.* Such, too, are the following: *The sun either moves round the earth, or is the centre about which the earth revolves. Friendship finds men equal, or makes them so.* It is the nature of all propositions of this class, supposing them to be exact in point of form, that upon determining the particular predicate, the rest are of course to be removed; or if all the predicates but one are removed; that one necessarily takes place. Thus, in the example above, if we allow the world to be the work of some wise and powerful cause, we of course deny it to be self-existent; or if we deny it to be self-existent, we must necessarily admit that it was produced by some wise and powerful cause. Now this particular manner of linking the predicates together, so that the establishing one displaces all the rest—or the excluding all but one necessarily establishes that one—cannot otherwise be effected than by means of *disjunctive* particles. And hence it is, that propositions of this class take their names from these particles which make so necessary a part of them, and indeed, constitute their very nature, considered as a distinct species. But I shall reserve what farther might be said on this head, till I come to treat of reasoning, where the great use and importance of disjunctive propositions will better appear.

CHAP. VI.

OF THE DIVISION OF PROPOSITIONS INTO SELF-EVIDENT AND DEMONSTRABLE.

SECTION I.

Design of this Chapter.

As we are soon to enter upon the third part of logic, which treats of reasoning—and as the art of reasoning lies in deducing propositions whose truth does not immediately appear, from others more known—it will be proper, before we proceed any farther, to examine a little the different degrees of evidence that accompany our judgments; that we may be the better able to distinguish in what cases we ought to have recourse to reasoning, and what those propositions are, upon which as a sure and unerring foundation, we may venture to build the truth of others.

SECTION II.

Propositions divided into Self-evident and Demonstrable.

When any proposition is offered to the view of the mind, if the terms, in which it is expressed, are understood; upon comparing the ideas together, the agreement or disagreement asserted is either immediately perceived, or found to lie beyond the present reach of the understanding. In the first case, the proposition is said to be *self-evident*, and admits not of any proof; because a bare attention to the ideas themselves produces full conviction and certainty; nor is it possible to call in any thing more evident by way of confirmation. But where the connexion or repugnance comes not so readily under the inspection of the mind, there we must have recourse to reasoning; and if, by a clear series of proofs, we can make out the truth proposed, insomuch that self-evidence shall accompany every step of the procedure, we are then able to demonstrate what we assert: and the proposition itself is said to be *demonstrable.* When we affirm, for instance, *that it is impossible for the same thing to be and not to be*; whoever understands the terms made use of, perceives, at first glance, the truth of what is asserted; nor can he, by any efforts, bring himself to believe the contrary. The proposition therefore is *self-evident*, and such that it is impossible by reasoning to make it plainer; because there is no truth more obvious, or better known, from which, as a consequence, it may be deduced. But if we say, *this world had a beginning*; the assertion is indeed equally true, but shines not forth with the same degree of evidence. We find great difficulty in conceiving how the world could be made out of nothing; and are not brought to a free and full consent, until by reasoning we arrive at a clear view of the absurdity involved in the contrary supposition. Hence this proposition is of the kind we call *demonstrable*, inasmuch as its truth is not immediately perceived by the mind, but yet may be made appear by means of others more known and obvious, whence it follows as an unavoidable consequence.

SECTION III.

Why the second Operation of the Mind is confined wholly to Intuition.

From what has been said, it appears that reasoning is employed only about demonstrable propositions, and that our intuitive and self-evident perceptions are the ultimate foundation on which it rests. And now we see clearly the reason, why in the distinction of the powers of the understanding, as explained in the introduction to the treatise, the second operation of the mind was confined wholly to intuitive acts. Our first step, in the way to knowledge, is to furnish ourselves with ideas. When these are obtained, we next set ourselves to compare them together, in order to judge of their agreement or disagreement.

If the relations we are in quest of, lie immediately open to the view of the mind, the judgments expressing them are self-evident; and the act of the mind, forming these judgments, is what we call intuition. But if, upon comparing our ideas together, we cannot readily and at once trace their relation, it then becomes necessary to employ search and examination, and call in the assistance of self-evident truths which is what we properly term *reasoning*. Every judgment, therefore, that is not intuitive, being gained by an exercise of the reasoning faculty, necessarily belongs to the third operation of the mind, and ought to be referred to it in a just division of the powers of the understanding. And indeed it is with this view chiefly, that we have distinguished propositions into self-evident and demonstrable. Under the first head are comprehended all our intuitive judgments, that is, all belonging to the second operation of the mind. Demonstrable propositions are the proper province of the reasoning faculty, and constitute by far the most considerable part of human knowledge. Indeed *reason* extends also to matters of experience and testimony, where the proofs adduced are not of the kind called demonstration. But I am here only considering the powers of the mind as employed in tracing the relations between its own ideas, in which view of things, every true proposition is demonstrable; though very often we find ourselves incapable of discovering and applying those intermediate ideas upon which the demonstration depends.

SECTION IV.

Self-evident Truths the first Principles of Reasoning.

Demonstrable propositions, therefore, belonging properly to the third operation of the mind, I shall, for the present, dismiss them, and return to the consideration of self-evident truths. These, as I have already observed, furnish the first principles of reasoning; and it is certain, that if in our researches, we employ only such principles as have this character of self-evidence, and apply them according to the rules to be afterwards explained, we shall be in no danger of error in advancing from one discovery to another. For this I may appeal to the writings of the mathematicians, which, being conducted by the express model here mentioned, are an incontestible proof of the firmness and stability of human knowledge, when built upon so sure a foundation. For not only have the propositions of this science stood the test of ages, but are found attended with such invincible evidence, as forces the assent of all who duly consider the proofs upon which they are established. Since then mathematicians are universally allowed to have hit upon the right method of arriving at truths—since they have been the happiest in the choice, as well as application of their principles—it may not be amiss to explain here the divisions they have given of self-evident propositions; that by treading in their steps, we may learn something of that justness and solidity of reasoning, for which they are so deservedly esteemed.

SECTION V.

Definitions a great help to Clearness and Evidence in Knowledge.

First, then, it is to be observed, that they have been very careful in ascertaining their ideas, and fixing the significations of their terms. For this purpose they begin with definitions, in which the meaning of their words is so distinctly explained, that they cannot fail to excite in the mind of an attentive reader the very same ideas as are annexed to them by the writer. And indeed I am apt to think, that the clearness and irresistible evidence of mathematical knowledge, is owing to nothing so much as this care in laying the foundation. Where the relation between any two ideas is accurately and justly traced, it will not be difficult for another to comprehend that relation, if in setting himself to discover it, he brings the very same ideas into comparison. But if, on the contrary, he affixes to his words ideas different from those that were in the mind of him who first advanced the demonstration; it is evident, that as the same ideas are not compared, the same relation cannot subsist, insomuch that a proposition will be rejected as false, which, had the terms been rightly understood, must have appeared unexceptionably true. A square, for instance, is a figure bounded by four equal right lines, joined together at right angles. Here the nature of the angles make no less a part of the idea, than the equality of the sides; and many properties demonstrated of the square, flow from its being a rectangular figure. If, therefore, we suppose a man who has formed a partial notion of a square, comprehending only the quality of its sides, without regard to the angles, reading some demonstration that implies also this latter consideration; it is plain he would reject it as not universally true, inasmuch as it could not be applied where the sides were joined together at unequal angles. For this last figure, answering still to his idea of a square, would be yet found without the property assigned to it in the proposition. But if he comes afterwards to correct his notion, and render his idea complete, he will then readily own the truth and justness of the demonstration.

SECTION VI.

Mathematicians by beginning with them, procure a ready reception to the Truths they advance.

We see, therefore, that nothing contributes so much to the improvement and certainty of human knowledge, as the having determinate ideas, and keeping them steady and invariable in all our discourses and reasonings about them. And on this account it is, that mathematicians, as was before observed, always begin by defining their terms, and distinctly unfolding the notions they are intended to express. Hence such as apply themselves to these studies, having exactly the same views of things, and bringing always the very same ideas into comparison, readily discern the relations between them, when clearly and distinctly represented. Nor is there any more natural and obvious reason for the universal reception given to mathematical truths, and for that harmony and correspondence of sentiments which makes the distinguishing character of the *literati* of this class.

SECTION VII.

The establishing of Principles the second Step in Mathematical Knowledge.

When they have taken this first step, and made known the ideas, whose relations they intend to investigate, their next care is, to lay down some self-evident truths, which may serve as a foundation for their future reasonings. And here, indeed, they proceed with remarkable circumspection, admitting no principles but what flow immediately from their definitions, and necessarily force themselves upon a mind in any degree attentive to its perceptions. Thus a *circle* is a figure formed by a right line, moving round some fixed point in the same plane. The fixed point, round which the line is supposed to move, and where one of its extremities terminates, is called the *centre* of the circle. The other extremity, which is conceived to be carried round, until it returns to the point whence it first set out, describes a curve running into itself, and termed the *circumference.* All right lines, drawn from the centre to the circumference, are called *radii.* From these definitions compared geometricians derive this self-evident truth, that the *radii of the same circle are all equal one to another.* I call it self-evident, because nothing more is required, to lay it open to the immediate perception of the mind than an attention to the ideas compared. For from the very nature of a circle it is plain, that the circumference is every where distant from the centre, by the exact length of the describing line; and that the several radii are in truth nothing more, that one and the same line variously posited within the figure. This short description will, I hope, serve to give some little insight into the manner of deducing mathematical principles, as well as into the nature of that evidence which accompanies them.

SECTION VIII.

Propositions divided into Speculative and Practical.

And now I proceed to observe, that in all propositions we either affirm or deny some property of the idea that constitutes the subject of our judgment, or we maintain that something may be done or effected. The first sort is called *speculative* propositions, as in the example mentioned above, *the radii of the same circle are all equal one to another.* The others are called *practical,* for a reason too obvious to be mentioned; thus, *that a right line may be drawn from one point to another,* is a practical proposition; inasmuch as it expresses that something may be done.

SECTION IX.

Hence Mathematical Principles distinguished into Axioms and Postulates.

From this twofold consideration of propositions, arises the twofold division of mathematical principles into *axioms* and *postulates*. By an *axiom* they understand any self-evident speculative truth: as, *that the whole is greater than its parts: that things equal to one and the same thing, are equal to one another.* But a self-evident *practical* proposition is what they call a *postulate.* Such as these of *Euclid; that a finite right line may be continued directly forwards: that a circle may be described about any centre with any distance.* And here we are to observe, that as in an *axiom,* the agreement or disagreement between the subject and predicate must come under the immediate inspection of the mind; so in a *postulate,* not only the possibility of the thing asserted must be evident at first view, but also the manner in which it may be effected. But where this manner is not of itself apparent, the proposition comes under the notion of the demonstrable kind, and is treated as such by the geometrical writers. Thus, *to draw a line from one point to another*, is assumed by *Euclid* as a *postulate*, because the manner of doing it is so obvious, as to require no previous teaching. But then it is not equally evident, *how we are to construct an equilateral triangle*. For this reason he advances it as a demonstrable proposition, lays down rules for the exact performance, and at the same time proves, that if these rules are followed, the figure will be justly described.

SECTION X.

And demonstrable Propositions into Theorems and Problems.

This naturally leads me to take notice that as *self-evident truths* are distinguished into different kinds according as they are speculative or practical; so is it also with *demonstrable* propositions. A demonstrable speculative proposition is by mathematicians called a *theorem*. Such is the famous 47th proposition of the first book of the *Elements*, known by the name of the *Pithagoric* theorem, from its supposed inventor, *Pithagoras*, *viz.* *That in every right-angled triangle, the square described upon the side subtending the right angle, is equal to both the squares described upon the sides containing the right angle.* On the other hand, a demonstrable practical proposition is called a *problem;* as where *Euclid* teaches us to *describe a square upon a given right line.*

SECTION XI.

Corollaries are obvious Deductions from Theorems or Problems.

Since I am upon this subject, it may not be amiss to add, that besides the four kinds of propositions already mentioned; mathematicians have also a fifth, known by the name of *corollaries*. These are usually subjoined to *theorems* or *problems*, and differ from them only in this, that they flow from what is there demonstrated, in so obvious a manner as to discover their dependence upon the proposition whence they are deduced, almost as soon as proposed. Thus *Euclid* having demonstrated, *that in every right-lined triangle, all the three angles taken together, are equal to two right angles*, adds, by way of corollary, *that all the three angles of any one triangle, taken together, are equal to all the three angles of any other triangle, taken together:* which is evident at first sight; because in all cases they are equal to two right ones, and things equal to two and the same thing, are equal to one another.

SECTION XII.

Scholia serves the purposes of Annotations or a Comment.

The last thing I shall take notice of, in the practice of the mathematicians, is, what they call their *scholia*. They are indifferently annexed to definitions, propositions, or corollaries; and answer the same purposes as annotations upon a classic author. For in them occasion is taken, to explain whatever may appear intricate and obscure in a train of reasoning: to answer objections; to teach the application and uses of propositions; to lay open the original and history of the several discoveries made in the science; and in a word, to acquaint us with all such particulars as deserve to be known, whether considered as points of curiosity or profit.

SECTION XIII.

This Method of the Mathematicians universal, and a sure guide to Certainty.

Thus we have taken a short view of the so much celebrated method of the mathematicians; which, to any one who considers it with a proper attention, must needs appear universal, and equally applicable in other sciences. They begin with definitions. From these they deduce their axioms and postulates, which serve as principles of reasoning; and having thus laid a firm foundation, advance to theorems and problems, establishing all by the strictest rules of demonstration. The corollaries flow naturally and of themselves. And if any particulars are still wanting to illustrate a subject or complete the reader's information; these, that the series of reasoning may not be interrupted or broken, are generally thrown into scholia. In a system of knowledge so uniform and well connected, no wonder if we meet with certainty; and if those clouds and darknesses, that deface other parts of human science, and bring discredit even upon reason itself, are here scattered and disappear.

SECTION XIV.

Self-evident Truths known by the apparent unavoidable Connexion between the Subject and predicate.

But I shall for the present wave these reflections, which every reader of understanding is able to make of himself, and return to the consideration of self-evident propositions. It will, doubtless, be expected, after what has been here said of them, that I should establish some *criteria*, or marks, by which they may be distinguished. But I frankly own my inability in this respect, as not being able to conceive any thing in them more obvious and striking, than that self-evidence which constitutes their very nature. All I have therefore to observe on this head, is, that we ought to make it our first care, to obtain clear and determinate ideas. When afterwards we come to compare these together, if we perceive between any of them a necessary and unavoidable connexion, insomuch that it is impossible to conceive them existing asunder, without destroying the very ideas compared; we may then conclude, that the proposition expressing this relation is a principle, and of the kind we call self-evident. In the example mentioned above, *the radii of the same circle are all equal between themselves;* this intuitive evidence shines forth in the clearest manner; it being impossible for any one, who attends his own ideas, not to perceive the equality here asserted. For as the circumference is every where distant from the centre by the exact length of the describing line, the radii drawn from the centre of the circumference, being severally equal to this one line, must needs also be equal among themselves. If we suppose the radii unequal, we at the same time suppose the circumference more distant from the centre in some places than in others; from which supposition, as it would exhibit a figure quite different from a circle, we see there is no separating the predicate from the subject in the proposition, without destroying the idea in relation to which the comparison was made. The same thing will be found to hold in all our other intuitive perceptions, insomuch that we may establish this as an universal *criterion*, whereby to judge of and distinguish them. I would not, however, be understood to mean, as if this ready view of the unavoidable connexion between some ideas was any thing really different from self-evidence. It is, indeed, nothing more than the notion of self-evidence a little unfolded, and as it were laid open to the inspection of the mind. Intuitive judgments need no other distinguishing marks, than that brightness which surrounds them; in like manner as light discovers itself by its own presence, and the splendour it universally diffuses. But I have said enough of self-evident propositions, and shall therefore now proceed to those of the demonstrable kind; which, being gained in consequence of reasoning, naturally leads us to the third part of logic, where this operation of the understanding is explained.

BOOK III.

Of Reasoning.

CHAP. I.

OF REASONING IN GENERAL, AND THE PARTS OF WHICH IT CONSISTS.

SECTION I.

Remote relations discovered by Means of intermediate Ideas.

WE have seen how the mind proceeds in furnishing itself with ideas, and framing intuitive perceptions. Let us next enquire into the manner of discovering those more remote relations, which, lying at a distance from the understanding are not to be traced but by means of a higher exercise of its powers. It often happens in comparing ideas together, that their agreement or disagreement cannot be discerned at first view, especially if they are of such a nature, as not to admit of an exact application one to another. When for instance, we compare two figures of a different make, in order to judge of their equality or inequality, it is plain, that by barely considering the figures themselves, we cannot arrive at an exact determination; because, by reason of their disagreeing forms, it is impossible so to put them together, as that their several parts shall mutually coincide. Here then it becomes necessary to look out for some third idea, that will admit of such an application as the present case requires; wherein if we succeed, all difficulties vanish, and the relation we are in quest of may be traced with ease. Thus right-lined figures are all reducible to squares, by means of which we can measure their areas, and determine exactly their agreement or disagreement in point of magnitude.

SECTION II.

This manner of arriving at Truth, and termed Reasoning.

If now it be asked, how any third idea can serve to discover a relation between two others; I answer, by being compared severally with these others; for such a comparison enables us to see how far the ideas, with which this third is compared, are connected or disjoined between themselves. In the example mentioned above, of two right-lined figures, if we compare each of them with some square whose area is known, and find the one exactly equal to it, and the other less by a square inch greater than that of the second. This manner of determining the relation between any two ideas, by the invention of some third with which they may be compared, is that which we call *reasoning*, and indeed the chief instrument, by which we push on our discoveries, and enlarge our knowledge. The great art lies, in finding out such intermediate ideas as, when compared with the others in the question, will furnish evident and known truths; because, as will afterwards appear, it is only by means of them, that we arrive at the knowledge of what is hidden and remote.

SECTION III.

The parts that constitute an Act of Reasoning and a Syllogism.

From what has been said, it appears that every act of reasoning necessarily includes three distinct judgments; two, wherein the ideas, whose relation we want to discover, are severally compared with the middle idea; and a third, wherein they are themselves connected or disjoined according to the result of that comparison. Now as in the second part of logic, our judgments, when put into words, were called propositions—so here, in the third part, the expressions of our reasonings are termed *syllogisms.* And hence it follows, that as every act of reasoning implies three several judgments, so every syllogism must include three distinct propositions. When a reasoning is thus put into words, and appears in form of a syllogism, the intermediate idea, made use of to discover the agreement or disagreement we search for, is called the *middle term ;* and the two ideas themselves, with which this third is compared, go by the name of the *extremes.*

SECTION IV.

Instance, Man and Accountableness.

But as these things are best illustrated by examples ; let us, for instance, set ourselves to inquire, *whether men are accountable for their actions.* As the relation between the ideas of *man* and *accountableness* comes not within the immediate view of the mind, our first care must be, to find out some third idea, that will enable us the more easily to discover and trace it. A very small measure of reflection is sufficient to inform us, that no creature can be accountable for his actions, unless we suppose him capable of distinguishing the good from the bad ; that is, unless we suppose him possessed of reason. Nor is this alone sufficient. For what would it avail him, to know good from bad actions, if he had no freedom of choice, nor could avoid the one, and pursue the other ? Hence it becomes necessary to take in both considerations in the present case. It is at the same time equally apparent, that wherever there is this ability of distinguishing good from bad actions, and pursuing the one and avoiding the other, there also a creature is accountable. We have then got a third idea, with which *accountableness* is inseparably connected, *viz. reason and liberty ;* which are here to be considered as making up one complex conception. Let us now take this middle idea, and compare it with the other term in the question, *viz. man*, and we all know by experience, that it may be affirmed of him. Having thus, by means of the intermediate idea, formed two several judgments, *viz. that man is possessed of reason and liberty;* and *that reason and liberty imply accountableness;* a third obviously and necessarily follows, *viz. that man is accountable for his actions.* Here then we have a complete act of reasoning, in which, according to what has been already observed, there are three distinct judgments; two that may be styled previous, inasmuch as they lead to the other, and arise from comparing the middle idea with the two ideas in the question; the third is a consequence of these previous acts, and flows from combining the extreme ideas between themselves. If now we put this reasoning into words, it exhibits what logicians term a syllogism, and, when proposed in due form, runs thus:

Every creature possessed of reason and liberty is accountable for his actions.

Man is a creature possessed of reason and liberty.

Therefore man is accountable for his actions.

SECTION V.

Premises, Conclusion, Extremes, Middle Term.

In this syllogism we may observe, that there are three several propositions, expressing the three judgments implied in the act of reasoning, and so disposed as to represent distinctly what passes within the mind, in tracing the more distant relations of its ideas. The two first propositions answer the two previous judgments in reasoning, and are called the *premises*, because they are placed before the other. The third is termed the *conclusion*, as being gained in consequence of what was asserted in the premises. We are also to remember, that the terms expressing the two ideas whose relation we enquire after, as here *man* and *accountableness*, are in general, called the *extremes;* and that the intermediate idea, by means of which the relation is traced, *viz. a creature possessed of reason and liberty*, takes the name of the *middle term.* Hence it follows, that by the *premises* of a syllogism, we are always to understand the two propositions, where the middle term is severally compared with *extremes ;* for these constitute the previous judgments, whence the truth we are in quest of is by reasoning deduced. The *conclusion* is, that other propositions, in which the *extremes* themselves are joined or separated, agreeably to what appears upon the above comparison. All this is evidently seen in the foregoing syllogism, where the two first propositions, which represent the premises, and the third, which makes the conclusion, are exactly agreeable to the definitions here given.

SECTION VI.

Major and Minor Term, Major and Minor Proposition.

Before we take leave of this article, it will be farther necessary to observe, that as the conclusion is made up of the extreme terms of the syllogism ; so that extreme, which serves as the predicate of the conclusion, goes by the name of the *major term :* the other extreme, which makes the subject in the same proposition, is called the *minor term.* From this distinction of the extremes, arises also a distinction between the premises, where these extremes are severally compared with the middle term. That proposition, which compares the greater extreme, or the predicate of the conclusion, with the middle term, is called the *major proposition :* the other, wherein the same middle term is compared with the subject of the conclusion, or lesser extreme, is called the *minor proposition.* All this is obvious from the syllogism already given, where the conclusion is, *man is accountable for his actions.* For here the predicate, *accountable for his actions*, being connected with the middle term in the first of the two premises. *Every creature possessed of reason and liberty is accountable for his actions*, gives what we call the *major proposition.* In the second of the premises, *man is a creature possessed of* *reason and liberty*, we find the lesser extreme; or subject of the conclusion, viz. *man*, connected with the same middle term, whence it is known to be the *minor proposition*. I shall only add, that when a syllogism is proposed in due form, the major proposition is always placed first, the minor next, and the conclusion last, according as we have done in that offered above.

SECTION VII.

Judgment and Proposition, Reasoning and Syllogism distinguished.

Having thus cleared the way, by explaining such terms, as we are likely to have occasion for in the progress of this treatise, it may not be amiss to observe, that though we have carefully distinguished between the *act of reasoning* and a *syllogism*, which is no more than the expression of it, yet common language is not so critical on this head; the term *reasoning* being promiscuously used, to signify either the judgments of the mind, as they follow one another in train, or the propositions expressing these judgments. Nor need we wonder that it is so, inasmuch as our ideas, and the terms appropriated to them, are so connected by habit and use, that our thoughts fall as it were spontaneously into language, as fast as they arise in the mind, so that even in our reasonings within ourselves, we are not able wholly to lay aside words. But notwithstanding this strict connexion between *mental* and *verbal* reasoning, if I may be allowed that expression, I thought it needful here to distinguish them, in order to give a just idea of the manner of deducing one truth from another. While the mind keeps the ideas of things in view, and combines its judgments according to the real evidence attending them, there is no great danger of mistake in our reasonings; because we carry our conclusions no farther than the clearness of our perceptions warrants us. But where we make use of words, the case is often otherwise; nothing being more common, than to let them pass without attending to the ideas they represent; insomuch that we frequently combine expressions, which upon examination appear to have no determinate meaning. Hence it greatly imports us to distinguish between reasoning and syllogism; and to take care, that the one be in all cases the true and just representation of the other. However, as I am unwilling to recede too far from the common forms of speech, or to multiply distinctions without necessity, I shall henceforward consider propositions as representing the real judgments of the mind, and syllogisms as the true copics of our reasonings; which indeed they ought always to be, and undoubtedly always will be, to men who think justly, and are desirous of arriving at truth. Upon this supposition there will be no danger in using the words judgment and proposition promiscuously; or in considering reasoning as either a combination of various judgments, or of the propositions expressing them; because, being the exact copies one of another, the result will be in all cases the same. Nor is it a small advantage, that we can thus conform to common speech, without confounding our ideas or running into ambiguity. By this means we bring ourselves upon a level with other men, readily apprehend the meaning of their expressions, and can with ease convey our own notions and sentiments into their minds.

SECTION VIII.

In a single Act of Reasoning, the Premises must be intuitive Truths.

These things premised, we may in the general define reasoning to be *an act or operation of the mind, deducing some unknown proposition, from other previous ones that are evident and known.* These previous propositions, in a simple act of reasoning, are only two in number; and it is always required that they be of themselves apparent to the understanding, insomuch that we assent to and perceive the truth of them as soon as proposed. In the syllogism given above, the premises are supposed to be self-evident truths, otherwise the conclusion could not be inferred by a single act of reasoning. If, for instance, in the major, *every creature possessed of reason and liberty is accountable for his actions*, the connexion between the subject and predicate could not be perceived by a bare attention to the ideas themselves; it is evident that this proposition would no less require a proof than the conclusion deduced from it. In this case, a new middle term must be sought for, to trace the connexion here supposed; and this of course furnishes another syllogism, by which, having established the proposition in question, we are then, and not before, at liberty to use it in any succeeding train of reasoning. And should it so happen, that in this second essay, there was still some previous proposition whose truth did not appear at first sight; we must then have recourse to a third syllogism, in order to lay open that truth to the mind; because, so long as the premises remain uncertain the conclusion built upon them must be so too. When by conducting our thoughts in this manner, we at last arrive at some syllogism, where the previous propositions are intuitive truths; the mind then rests in full security, as perceiving that the several conclusions it has passed through stand upon the immoveable foundation of self-evidence, and, when traced to their source, terminate in it.

SECTION IX.

Reasoning in the highest exercise of it only a Concatenation of Syllogisms.

We see, therefore, that in order to infer a conclusion by a single act of reasoning, the premises must be intuitive propositions. Where they are not, previous syllogisms are required, in which case reasoning becomes a complicated act, taking in a variety of successive steps. This frequently happens in tracing the more remote relations of our ideas, where many middle terms being called in the conclusion cannot be made out, but in consequence of a series of syllogisms following one another in train. But although in this concatenation of propositions, those that form the premises of the last syllogism, are often considerably removed from self-evidence; yet if we trace the reasoning backwards, we shall find them the conclusions of previous syllogisms, whose premises approach nearer and nearer to intuition in proportion as we advance, and are found at last to terminate in it. And if after having thus unravelled a demonstration, we take it the contrary way, and observe how the mind, setting out with intuitive perceptions, couples them together to form a conclusion—how, by introducing this conclusion into another syllogism, it still advances one step farther; and so proceeds, making every new discovery subservient to its future progress—we shall then perceive clearly, that reasoning, in the highest exercise of that faculty, is no more than an orderly combination of those simple acts, which we have already so fully explained. The great art lies, in so adjusting our syllogisms one to another, that the propositions severally made use of, as premises, may be manifest consequences of what goes before. For as by this means, every conclusion is deduced from known and established truths, the very last in the series, how far soever we carry it, will have no less certainty attending it, than the original intuitive perceptions themselves in which the whole chain of syllogisms takes its rise.

SECTION X.

Requires intuitive Certainty in every Step of the Progression.

Thus we see, that reasoninng, begining with first principles, rises gradually from one judgment to another, and connects them in such manner, that every stage of the progression brings intuitive certainty along with it. And now at length we may clearly understand the definition given above, of this distinguishing faculty of the human mind. Reason, we have said, is the ability of deducing unknown truths, from principles or propositions that are already known. This evidently appears, by the foregoing account, where we see, that no proposition is admitted into a syllogism, to serve as one of the previous judgments on which the conclusion rests, unless it is itself a known and established truth, whose connexion with self-evident principles has been already traced.

SECTION XI.

Self-evident Truths, the ultimate Foundation of all Science and Certainty.

There is yet another observation which naturally offers itself, in consequeuce of the above detail, viz. that all the knowledge acquired by reasoning, how far soever we carry our discoveries, is still built upon our intuitive perceptions. Towards the end of the last part, we divided propositions into self-evident and demonstrable, and represented those of the self-evident kind, as the foundation on which the whole superstructure of human science rested. This doctrine is now abundantly confirmed by what has been delivered in the present chapter. We have found, that every discovery of human reason, is the consequence of a train of syllogisms, which, when traced to their source, always terminate in self-evident perceptions. When the mind arrives at these primitive truths, it pursues not its inquiries farther, as well knowing, that no evidence can exceed that which flows from an immediate view of the agreement or disagreement between its ideas. And hence it is, that in unravelling any part of knowledge, in order to come at the foundation on which it stands; intuitive truths are always the last resort of the understanding, beyond which it aims not to advance, but possesses its notions in perfect security, as having now reached the very spring and fountain of all science and certainty.

CHAP. II.

OF THE SEVERAL KINDS OF REASONING, AND FIRST OF THAT BY WHICH WE DETERMINE THE GENERA AND SPECIES OF THINGS.

SECTION I.

Reasoning Twofold.

We have endeavoured, in the foregoing chapter, to give as distinct a notion as possible, of reasoning, and of the manner in which it is conducted. Let us now inquire a little into the discoveries made by this faculty, and what those ends are, which we have principally in view in the exercise of it. All the aims of human reason may, in the general, be reduced to these two: 1. To rank things under those universal ideas to which they truly belong; and 2. To ascribe to them their several attributes and properties, in consequence of that distribution.

SECTION II.

The first kind regards the Genera and Species of Things.

First, then, I say, that one great aim of human reason is, to determine the genera and species of things. We have seen, in the first part of this treatise, how the mind proceeds in framing general ideas. We have also seen, in the second part, how, by means of these general ideas, we come by universal propositions. Now, as in these universal propositions, we affirm some property of a genus or species, it is plain, that we cannot apply this property to particular objects, till we have first determined, whether they are comprehended under that general idea, of which the property is affirmed. Thus there are certain properties belonging to all *even* numbers, which nevertheless cannot be applied to any particular number, until we have first discovered it to be of the species expressed by that general name. Hence reasoning begins with referring things to their several divisions and classes in the scale of our ideas; and as these divisions are all distinguished by peculiar names, we hereby learn to apply the terms expressing general conceptions, to such particular objects, as come under our immediate observation.

SECTION III.

The Steps by which we arrive at Conclusions of this sort.

Now, in order to arrive at these conclusions, by which the several objects of perceptions are brought under general names, two things are manifestly necessary. First, that we take a view of the idea itself denoted by that general name, and carefully attend to the distinguishing marks which serve to characterize it. Secondly, that we compare this idea with the object under consideration, observing diligently wherein they agree or differ. If the idea is found to correspond with the particular object, we then, without hesitation, apply the general name; but if no such correspondence intervenes, the conclusion must necessarily take a contrary turn. Let us, for instance, take the number *eight*, and consider by what steps we are led to pronounce it an *even* number. First, then, we call to mind the idea signified by the expression, *an even number*, viz. that it is *a number divisible into two equal parts.* We then compare this idea with the number *eight*, and finding them manifestly to agree, see at once the necessity of admitting the conclusion. These several judgments therefore, transferred into language, and reduced to the form of a syllogism, appear thus;

Every number that may be divided into two equal parts, is an even number.

The number *eight* may be divided into two equal parts.
Therefore the number *eight* is an *even* number.

SECTION IV.

Those Steps always followed, though in familiar Cases we do not always attend to them.

I have made choice of this example, not so much for the sake of the conclusion, which is obvious enough, and might have been obtained without all that parade of words; but chiefly because it is of easy comprehension, and serves at the same time distinctly to exhibit the form of reasoning by which the understanding conducts itself in all instances of this kind. And here it may be observed, that where the general idea, to which particular objects are referred, is very familiar to the mind, and frequently in view, this reference, and the application of the general name, seem to be made without any apparatus of reasoning. When we see a horse in the fields, or a dog in the street, we readily apply the name of the species; habit, and a familiar acquaintance with the general idea, suggesting it instantaneously to the mind. We are not, however, to imagine on this account, that the understanding departs from the usual rules of just thinking. A frequent repetition of acts begets a habit; and habits are attended with a certain promptness of execution, that prevents our observing the several steps and gradations, by which any course of action is accomplished. But in other instances, where we judge not by precontracted habits, as when the general idea is very complex, or less familiar to the mind; we always proceed according to the form of reasoning established above. A goldsmith, for instance, who is in doubt as to any piece of metal, whether it be of the species called *gold*, first examines its properties, and then comparing them with the general idea signified by that name, if he find a perfect correspondence, no longer hesitates under what class of metals to rank it. Now what is this, but following step by step those rules of reasoning, which we have before laid down as the standards, by which to regulate our thoughts in all conclusions of this kind?

SECTION V.

The Great Importance of this Branch of Reasoning.

Nor let it be imagined, that our researches here, because in appearance bounded to the imposing of general names upon particular objects, are therefore trivial and of little consequence. Some of the most considerable debates among mankind, and such too, as nearly regard their lives, interest, and happiness, turn wholly upon this article. Is it not the chief employment of our several courts of judicature, to determine, in particular instances, what is law, justice, and equity? Of what importance is it, in many cases, to decide aright, whether an action shall be termed murder or manslaughter. We see, that no less than the lives and fortunes of men depend often upon these decisions. The reason is plain. Actions, when once referred to a general idea, draw after them all that may be affirmed of that idea; insomuch that the determining the species of actions, is all one with determining what proportion of praise or dispraise, commendation or blame, &c. ought to follow them. For as it is allowed that murder deserves death, by bringing any particular action under the head of murder, we of course decide the punishment due to it.

SECTION VI.

And the exact Observance of it practised by Mathematicians.

But the great importance of this branch of reasoning, and the necessity of care and circumspection, in referring particular objects to general ideas, is still farther evident from the practice of the mathematicians. Every one who has read *Euclid*, knows, that he frequently requires us to draw lines through certain points, and according to such and such directions. The figures thence resulting are often squares, parallelograms, or rectangles. Yet *Euclid* never supposes this from their bare appearance, but always demonstrates it upon the strictest principles of geometry. Nor is the method he takes, in any thing different from that described above. Thus, for instance, having defined a square to be a figure bounded by four equal sides, joined together at right angles; when such a figure arises in any construction previous to the demonstration of a proposition, he yet never calls it by that name, until he has shown that the sides are equal, and all its angles right ones. Now this is apparently the same form of reasoning we have before exhibited, in proving *eight* to be an even number; as will be evident to any one who reduces it into a regular syllogism. I shall only add, that when *Euclid* has thus determined the species of any figure, he is then, and not before, at liberty to ascribe to it all the properties already demonstrated of that figure; and thereby render it subservient to the future course of his reasoning.

SECTION VII.

Fixed and invariable Ideas, with a steady application of Names, renders this part of Knowledge both easy and certain.

Having thus sufficiently explained the rules by which we are to conduct ourselves, in ranking particular objects under general ideas, and show their conformity to the practice and manner of the mathematicians; it remains only to observe, that the true way of rendering this part of knowledge both easy and certain, is, by habituating ourselves to clear and determinate ideas, and keeping them steadily annexed to their respective names. For as all our aim is, to apply general words aright, if these words stand for invariable ideas, that are perfectly known to the mind, and can be readily distinguished upon occasion, there will be little danger of mistake or error in our reasonings. Let us suppose, that by examining any object, and carrying our attention successively from one part to another, we have acquainted ourselves with the several particulars observable in it. If among these we find such as constitute some general idea, framed and settled beforehand by the understanding, and distinguished by a particular name; the resemblance, thus known and perceived, necessarily determines the species of the object, and thereby gives it a right to the name by which that species is called. Thus, four equal sides, joined together at right angles, make up the notion of a *square*. As this is a fixed and invariable idea, without which the general name cannot be applied, we never call any particular figure a *square*, until it appears to have these several conditions; and contrarily, wherever a figure is found with these conditions, it necessarily takes the name of a *square*. The same will be found to hold in all our other reasonings of this kind; where nothing can create any difficulty but the want of settled ideas. If, for instance, we have not determined within ourselves, the precise notion denoted by the word *manslaughter*, it will be impossible for us to decide, whether any particular action ought to bear that name: because, however nicely we examine the action itself, yet, being strangers to the general idea with which it is to be compared, we are utterly unable to judge of their agreement or disagreement. But if we take care to remove this obstacle, and distinctly trace the two ideas under consideration, all difficulties vanish, and the resolution becomes both easy and certain.

SECTION VIII.

By such a Conduct, Certainty and Demonstration might be introduced into other Parts of Knowledge as well as Mathematics.

Thus we see of what importance it is, towards the improvement and certainty of human knowledge, that we accustom ourselves to clear and determinate ideas, and a steady application of words. Nor is this so easy a task as some may, perhaps, be apt to imagine; it requiring both a comprehensive understanding, and great command of attention, to settle the precise bounds of our ideas, when they grow to be very complex, and include a multitude of particulars. Nay, and after these limits are duly fixed, there is a certain quickness of thought and extent of mind required towards keeping the several parts in view, that in comparing our ideas one with another, none of them may be overlooked. Yet ought not these difficulties to discourage us; though great, they are not unsurmountable, and the advantages arising from success will amply recompense our toil. The certainty and easy application of mathematical knowledge is wholly owing to the exact observance of this rule. And I am apt to imagine, that if we were to employ the same care about all our other ideas, as mathematicians have done about those of number and magnitude, by forming them into exact combinations, and distinguishing these combinations by particular names, in order to keep them steady and invariable; we would soon have it in our power to introduce certainty and demonstration into other parts of human knowledge.

CHAP. III.

OF *REASONING* AS IT REGARDS THE POWERS AND PROPERTIES OF THINGS, AND THE RELATIONS OF OUR GENERAL IDEAS.

SECTION I.

The Distinction of Reasonings as it regards the Sciences, and as it concerns common Life.

We come now to the second great end which men have in view in their reasonings, namely, the discovering and ascribing to things their several attributes and properties. And here it will be necessary to distinguish between reasoning, as it regards the sciences, and as it concerns common life. In the sciences, our reason is employed chiefly about universal truths, it being by them alone that the bounds of human knowledge are enlarged. Hence the division of things, into various classes, called otherwise genera and species. For these universal ideas, being set up as the representatives of many particular things, whatever is affirmed of them, may also be affirmed of all the individuals to which they belong. *Murder*, for instance, is a general idea, representing a certain species of human actions. Reason tell us, that the punishment due to it is *death*. Hence every particular action coming under the notion of *murder*, has the punishment of *death* allotted to it. Here then we apply the general truth to some obvious instance, and this is what properly constitutes the reasoning of common life. For men in their ordinary transactions and intercourse one with another, have for the most part to do only with particular objects. Our friends and relations, their characters and behaviours, the constitution of the several bodies that surround us, and the uses to which they may be applied, are what chiefly engage our attention. In all these we reason about particular things; and the whole result of our reasoning is, the applying the general truths of the sciences to the ordinary transactions of human life. When we see a viper, we avoid it. Wherever we have occasion for the forcible action of water, to move a body that makes considerable resistance, we take care to convey it in such a manner, that it shall fall upon the object with impetuosity. Now all this happens, in consequence of our familiar and ready application of these two general truths: *the bite of a viper is mortal: water falling on a body with impetuosity, acts very forcibly towards setting it in motion.* In like manner, if we set ourselves to consider any particular character in order to determine the share of praise or dispraise that belongs to it, our great concern is, to ascertain exactly the proportion of virtue and vice. The reason is obvious. A just determination, in all cases of this kind, depends entirely upon an application of these maxims of morali-

ty: virtuous actions deserve praise: vicious actions deserve blame.

SECTION II.

The Steps by which we proceed in the Reasoning of common Life.

Hence it appears, that reasoning, as it regards common life, is no more than the ascribing the general properties of things to those several objects with which we are immediately concerned, according as they are found to be of that particular division or class to which the properties belong. The steps, then, by which we proceed, are manifestly these: First, we refer the object under consideration to some general idea or class of things. We then recollect the several attributes of that general idea: and, lastly, ascribe all those attributes to the present object. Thus in considering the character of *Sempronius*, if we find it to be of the kind called *virtuous;* when we at the same time reflect, that a *virtuous* character is deserving of esteem, it naturally and obviously follows, that *Sempronius* is so too. These thoughts put into a *syllogism*, in order to exhibit the form of reasoning here required, runs thus:

Every virtuous man is worthy of esteem.
Sempronius is a virtuous man:
Therefore *Sempronius* is worthy of esteem.

SECTION III.

The Connexion and Dependence of the two grand Branches of Reasoning one upon another.

By this *syllogism* it appears, that before we affirm any thing of a particular object, that object must be referred to some general idea. *Sempronius* is pronounced worthy of esteem, only in consequence of his being a virtuous man, or coming under that general notion. Hence we see the necessary connexion of the various parts of reasoning, and the dependence they have one upon another. The determining the genera and species of things, is, as we have said, one exercise of human reason; and here we find that this exercise is the first in order, and previous to the other, which consists in ascribing to them their powers, properties, and relations. But when we have taken this previous step, and brought particular objects under general names; as the properties we ascribe to them are no other than those of the general idea, it is plain, that in order to a successful progress in this part of knowledge, we must thoroughly acquaint ourselves with the several relations and attributes of these our general ideas. When this is done, the other part will be easy, and require scarce any labour of thought, as being no more than an application of the general form of reasoning represented in the foregoing *syllogism*. Now, as we have already sufficiently shown, how we are to proceed in determining the genera and species of things, which, as we have said, is the previous step to this second branch of human knowledge; all that is farther wanting to a due explanation of it is, to offer some considerations, as to the manner of investigating the general relations of our ideas. This is the highest exercise of the powers of the understanding, and that by means whereof, we arrive at the discovery of universal truths; insomuch that our deductions in this way, constitute that particular species of reasoning which, we have before said, regards principally the sciences.

SECTION IV.

Two Things required to make a good Reasoner.

But that we may conduct our thoughts with some order and method, we shall begin with observing, that the relations of our general ideas are of two kinds. Either such as immediately discover themselves, upon comparing the ideas one with another; or such as, being more remote and distant, require art and contrivance to bring them into view. The relations of the first kind, furnish us with intuitive and self-evident truths: those of the second are traced by reasoning, and a due application of intermediate ideas. It is of this last kind that we are to speak here, having dispatched what was necessary with regard to the other in the second part. As therefore, in tracing the more distant relations of things, we must always have recourse to intervening ideas, and are more or less successful in our researches, according to our acquaintance with these ideas, and ability of applying them; it is evident, that to make a good reasoner, two things are principally required. *First*, an extensive knowledge of those intermediate ideas by means of which things may be compared one with another. *Secondly*, the skill and talent of applying them happily, in all particular instances that come under consideration.

SECTION V.

First, an extensive Knowledge of intermediate Ideas.

First, I say, that in order to our successful progress in reasoning, we must have an extensive knowledge of those intermediate ideas by means of which things may be compared one with another. For as it is not every idea that will answer the purpose of our inquiries, but such only as are peculiarly related to the objects about which we reason, so as by a comparison with them, to furnish evident and known truths; nothing is more apparent, than that the greater variety of conceptions we can call into view, the more likely we are to find some among them that will help us to the truths here required. And indeed it is found to hold in experience, that in proportion as we enlarge our view of things, and grow acquainted with a multitude of different objects, the reasoning quality gathers strength. For by extending our sphere of knowledge, the mind acquires a certain force and penetration, as being accustomed to examine the several appearances of its ideas, and observe what light they cast one upon another.

SECTION VI.

To excel in any one Branch of Learning, we must in general be acquainted with the whole circle of Arts and Sciences.

And this I take to be the reason, that in order to excel remarkably in any one branch of learning, it is necessary to have at least a general acquaintance with the whole circle of arts and sciences. The truth of it is, all the various divisions of human knowledge are very nearly related among themselves, and innumerable instances serve to illustrate and set off each other. And although it is not to be denied, that by an obstinate application to one branch of study, a man may make considerable progress, and acquire some degree of eminence in it; yet his views will be always narrow and contracted, and he will want that masterly discernment which not only enables us to pursue our discoveries with ease, but also in laying them open to others, to spread a certain brightness around them. I would not however, here be understood to mean, that a general knowledge alone is sufficient for all the purposes of reasoning. I only recommend it as proper to give the mind a certain sagacity and quickness, and qualify it for judging aright in the ordinary occurrences of life. But when our reasoning regards a particular science, it is farther necessary, that we more nearly acquaint ourselves with whatever relates to that science. A general knowledge is a good preparation, and enables us to proceed with ease and expedition in whatever branch of learning we apply to. But then in the minute and intricate questions of any science, we are by no means qualified to reason with advantage, until we have perfectly mastered the science to which they belong; it being hence chiefly that we are furnished with those intermediate ideas, which lead to a just and successful solution.

SECTION VII.

Why Mathematicians sometimes answer not the Expectation their great Learning raises.

And here as it comes so naturally in my way, I cannot avoid taking notice of an observation that is frequently to be met with, and seems to carry in it at first sight something very strange and unaccountable. It is, in short, this, that mathematicians, even such as are allowed to excel in their own profession, and to have discovered themselves perfect masters in the art of reasoning have not yet been always happy in treating upon other subjects; but rather fallen short, not only what might naturally have been expected from them, but of many writers much less exercised in the rules of the argumentation. This will not appear so very extraordinary, if we reflect on what has been hinted above. Mathematics is an engaging study; and men who apply themselves that way, so wholly plunge into it, that they are for the most but little acquainted with other branches of knowledge. When, therefore, they quit their favourite subject, and enter upon others, that are in a manner new and strange to them, no wonder if they find their invention at a stand. Because, however perfect they may be in the art of reasoning, yet wanting here those intermediate ideas which are necessary to furnish out a due train of propositions, all their skill and ability fails them. For a bare knowledge of the rules is not sufficient. We must farther have materials whereunto to apply them. And when these are once obtained, then it is that an able reasoner discovers his superiority, by the just choice he makes, and a certain masterly disposition, that in every step of the procedure carries evidence and conviction along with it. And hence it is, that such mathematicians as have of late years applied themselves to other sciences, and not contented with a superficial knowledge, endeavoured to reach their inmost recesses; such mathematicians, I say, have, by mere strength of mind, and a happy application of geometrical reasoning, carried their discoveries far beyond what was heretofore judged the utmost limits of human knowledge. This is a truth abundantly known to all who are acquainted with the late wonderful improvements in natural philosophy.

SECTION VIII.

Secondly, the Skill of applying Intermediate Ideas happily in particular instances.

I come now to the second thing required, in order to a successful progress in reasoning, namely, the skill and talent of applying intermediate ideas happily in all particular instances that come under consideration. And here I shall not take up much time in laying down rules and precepts, because I am apt to think they would do but little service. Use and exercise are the best instructors in the present case: and whatever logicians may boast, of being able to form perfect reasoners by book and rule, yet we find by experience, that the study of their precepts does not always add any great degree of strength to the understanding. In short, 'tis the habit alone of reasoning that makes a reasoner. And therefore the true way to acquire this talent, is, by being much conversant in those sciences where the art of reasoning is allowed to reign in the greatest perfection. Hence it was, that the ancients, who so well understood the manner of forming the mind, always began with mathematics as the foundation of their philosophical studies. Here the understanding is by degrees habituated to truth, contracts insensibly a certain fondness for it, and learns never to yield its assent to any proposition, but where the evidence is sufficient to produce full conviction. For this reason, *Plato* has called mathematical demonstrations the *cathartics* or purgatives of the soul, as being the proper means to cleanse it from error, and restore that natural exercise of its faculties in which just thinking consists. And indeed I believe it will be readily allowed, that no science furnishes so many instances of a happy choice of intermediate ideas, and a dexterous application of them, for the discovery of truth and enlargement of knowledge.

SECTION IX.

The Study of Mathematical Demonstrations of great avail in this respect.

If, therefore, we would form our minds to a habit of reasoning closely and in train, we cannot take any more certain method, than the exercising ourselves in mathematical demonstrations, so as to contract a kind of familiarity with them; "not that we look upon it as necessary, (*to use the words of the great Mr. Locke*) that all men should be deep mathematicians, but that, having got the way of reasoning which that study necessarily brings the mind to, they may be able to transfer it to other parts of knowledge, as they shall have occasion. For in all sorts of reasoning every single argument should be managed as a mathematical demonstration, the connexion and dependence of ideas should be followed, till the mind is brought to the source on which it bottoms, and can trace the coherence through the whole train of proofs. It is in the general observable, that the faculties of our souls are improved and made useful to us just after the same manner as our bodies are. Would you have a man write or paint, dance or fence well, or perform any other manual operation, dexterously and with ease? Let him have ever so much vigour and activity, suppleness and address naturally, yet no body expects this from him, unless he has been used to it, and has employed time and pains in fashioning and forming his hand, or outward parts to these motions. Just so it is in the mind; would you have a man reason well, you must use him to it betimes, exercise his mind in observing the connexion of ideas, and following them in train. Nothing does this better than mathematics; which, therefore, I think should be taught all those who have the time and opportunity, not so much to make them mathematicians, as to make them reasonable creatures; for though we all call ourselves so, because we are born to it, if we please; yet we may truly say, nature gives us but the seeds of it. We are born to be if we please, rational creatures; but 'tis use and exercise only that makes us so, and we are indeed so, no farther than industry and application has carried us." *Conduct of the Understanding.*

SECTION X.

As also of such Authors on other Subjects, as are distinguished for Strength and justness of Reasoning.

But although the study of mathematics be, of all others, the most useful to form the mind and give it an early relish of truth, yet ought not other parts of philosophy to be neglected. For there also we meet with many opportunities of exercising the powers of the understanding; and the variety of subjects naturally lead us to observe all those different turns of thinking that are peculiarly adapted to the several ideas we examine, and the truths we search after. A mind thus trained, acquires a certain mastery over its own thoughts, insomuch that it can range and model them at pleasure, and call such into view as best suit its present designs. Now in this the whole art of reasoning consists, from among a great variety of different ideas, to single out those that are most proper for the business in hand, and to lay them together in such order, that from plain and easy beginnings, by gentle degrees, and a continual train of evident truths, we may be insensibly led on to such discoveries, as at our first setting out, appeared beyond the reach of the human understanding. For this purpose, besides the study of mathematics before recommended, we ought to apply ourselves diligently to the reading of such authors as have distinguished themselves for strength of reasoning, and a just and accurate manner of thinking. For it is observable, that a mind exercised and seasoned to truth seldom rests satisfied in a bare contemplation of the arguments offered by others, but will be frequently essaying its own strength, and pursuing its discoveries upon the plan it is most accustomed to. Thus we insensibly contract a habit of tracing truth from one stage to another, and of investigating those general relations and properties which we afterwards ascribe to particular things, according as we find them comprehended under the abstract ideas to which the properties belong. And thus having particularly shown how we are to distribute the several objects of nature under general ideas, what properties we are to ascribe to them in consequence of that distribution, and how to trace and investigate the properties themselves; I think I have sufficiently explained all that is necessary towards a due conception of reasoning, and shall therefore here conclude this chapter.

CHAP. IV.

OF THE FORMS OF SYLLOGISMS.

SECTION I.

The Figures of Syllogisms.

HITHERTO we have contented ourselves with a general notion of syllogisms, and of the parts of which they consist. It is now time to enter a little more particularly into the subject, to examine their various forms, and to lay open the rules of argumentation proper to each. In the syllogisms mentioned in the foregoing chapters, we may observe, that the *middle term* is the subject, of the *major* proposition, and the predicate of the *minor*. This disposition, though the most natural and obvious, is not, however, necessary; it frequently happening that the *middle term* is the subject in both the premises, or the predicate in both; and sometimes, directly contrary to its disposition in the foregoing chapters, the predicate in the *major*, and the subject in the *minor*. Hence the distinction of syllogisms into various kinds, called *figures* by logicians. For *figure*, according to their use of the word, is nothing else but the order and disposition of the *middle term* in any syllogism. And as this disposition is, we see, four-fold, so the figures of syllogisms thence arising are four in number. When the *middle term* is the subject of the *major* proposition, and the predicate of the *minor*, we have what is called the *first figure*. If on the other hand, it is the predicate of both the premises, the syllogism is said to be in the *second figure*. Again, in the *third figure*, the *middle term* is the subject of the two premises. And lastly, by making it the predicate of the *major*, and subject of the *minor*, we obtain syllogisms in the *fourth figure*.

SECTION II.

The Moods of Syllogisms.

But besides this four-fold distinction of syllogisms, there is also a farther subdivision of them in every figure, arising from the *quantity* and *quality*, as they are called, of the propositions. By *quantity* we mean the consideration of propositions as universal or particular; by *quality* as affirmative or negative. Now as in all the several dispositions of the *middle term*, the propositions, of which a syllogism consists, may be either universal or particular, affirmative or negative; the due determination of these, and so putting them together as the laws of argumentation require, constitute what logicians call the *moods* of syllogisms. Of these *moods* there are a determinate number to every figure, including all the possible ways in which propositions differing in *quantity* or *quality* can be combined, according to any disposition of the *middle term*, in order to arrive at a just conclusion.

The shortness of the present work will not allow of entering into a more particular description of these several distinctions and divisions. I shall therefore content myself with referring the reader to the *Port Royal art of thinking*, where he will find the *moods* and *figures* of syllogisms distinctly explained, and the rules proper to each very neatly demonstrated.

SECTION III.

Foundation of the other Divisions of Syllogisms.

The division of syllogisms, according to mood and figure, respects those especially, which are known by the name of plain simple syllogisms; that is, which are bounded to three propositions, all simple, and where the extremes and middle term are connected, according to the rules laid down above. But as the mind is not tied down to any one precise form of reasoning, but sometimes makes use of more, sometimes of fewer premises, and often takes in compound and conditional propositions, it may not be amiss to take notice of the different forms derived from this source, and explain the rules by which the mind conducts itself in the use of them.

SECTION IV.

Conditional Syllogisms.

When, in any syllogism, the *major* is a conditional proposition, the syllogism itself is termed *conditional.* Thus:

If there is a God, he ought to be worshipped.
But there is a God:
Therefore he ought to be worshipped.

In this example, the *major* or first proposition, is, we see, conditional, and therefore the syllogism itself is also of the kind called by that name. And here we are to observe, that all conditional propositions are made up of two distinct parts; one expressing the condition upon which the predicate agrees or disagrees with the subject, as in this now before us, *if there is a God;* the other joining or disjoining the said predicate and subject, as here, *he ought to be worshipped.* The first of these parts, or that which implies the condition, is called the *antecedent;* the second, where we join or disjoin the predicate and subject, has the name of the *consequent.*

SECTION V.

Ground of Illation in conditional Syllogisms.

These things explained, we are farther to observe, that in all propositions of this kind, supposing them to be exact in point of form. the relation between the antecedent and consequent, must ever be true and real ; that is, the antecedent must always contain some certain or genuine condition which necessarily implies the consequent ; for otherwise, the proposition itself will be false, and therefore ought not to be admitted into our reasonings. Hence it follows, that when any conditional proposition is assumed, if we admit the antecedent of that proposition, we must, at the same time, necessarily admit the consequent : but if we reject the consequent, we are, in like manner, bound to reject also the antecedent. For as the antecedent always expresses some condition which necessarily implies the truth of the consequent ; by admitting the antecedent, we allow of that condition, and therefore ought also to admit the consequent. In like manner, if it appears that the consequent ought to be rejected, the antecedent evidently must be so too ; because, as we just now demonstrated, the admitting of the antecedent would necessarily imply the admission also of the consequent.

SECTION VI.

The two Moods of Conditional Syllogism.

From what has been said, it appears, that there are two ways of arguing in *hypothetical* syllogism, which lead to a certain and unavoidable conclusion. For as the *major* is always a conditional proposition, consisting of an antecedent, and a consequent; if the *minor* admits the antecedent, it is plain that the conclusion must admit the consequent. This is called arguing from the admission of the antecedent to the admission of the consequent, and constitutes that mood or species of *hypothetical* syllogisms, which is distinguished in the schools by the name of the *modus ponens*, inasmuch as by it the whole conditional proposition, both antecedent and consequent, is established. Thus,

If God is infinitely wise, and acts with perfect freedom, he does nothing but what is best.

But God is infinitely wise, and acts with perfect freedom:

Therefore he does nothing but what is best.

Here we see the antecedent or first part of the conditional proposition is established in the *minor*, and the consequent or second part in the conclusion; whence the syllogism itself is an example of the *modus ponens*. But if now we on the contrary suppose, that the *minor* rejects the consequent, then it is apparent, that the conclusion must also reject the antecedent. In this case we are said to argue from the removal of the consequent to the removal of the antecedent; and the particular mood or species of syllogism thence arising is called by logicians the *modus tollens;* because in it, both antecedent and consequent are rejected or taken away, as appears by the following example:

If God were not a Being of infinite goodness, neither would he consult the happiness of his creatures.

But God does consult the happiness of his creatures:

Therefore he is a Being of infinite goodness.

SECTION VII.

They include all the Legitimate Ways of Arguing.

These two species take in the whole class of *conditional* syllogisms, and include all the possible ways of arguing that lead to a legitimate conclusion; because we cannot here proceed by a contrary process of reasoning, that is, from the removal of the antecedent to the removal of the consequent, or from the establishing of the consequent to the establishing of the antecedent. For although the antecedent always expresses some real condition, which, once admitted, necessarily implies the consequent, yet it does not follow, that there is therefore no other condition; and if so, then, after removing the antecedent, the consequent may still hold, because of some other determination that infers it. When we say: *If a stone is exposed some time to the rays of the sun, it will contract a certain degree of heat*; the proposition is certainly true, and, admitting the antecedent, we must also admit the consequent. But as there are other ways by which a stone may gather heat, it will not follow from the ceasing of the before-mentioned condition, that therefore the consequent cannot take place. In other words, we cannot argue, *but the stone has not been exposed to the rays of the sun; therefore neither has it any degree of heat*; inasmuch as there are a great many other ways by which heat might have been communicated to it. And if we cannot argue from the removal of the antecedent to the removal of the consequent, no more can we from the admission of the consequent to the admission of the antecedent. Because, as the consequent may flow from a great variety of different suppositions, the allowing of it does not determine the precise supposition, but only that some of them must take place. Thus in the foregoing propositions, *if a stone is exposed some time to the rays of the sun, it will contract a certain degree of heat*: admitting the consequent, viz. *that it has contracted a certain degree of heat*, we are not therefore bound to admit the antecedent, *that it has been sometime exposed to the rays of the sun*; because there are many other causes whence that heat may have proceeded. These two ways of arguing, therefore, hold not in the conditional syllogisms. Indeed, where the antecedent expresses the only condition on which the consequent takes place, there they may be applied with safety; because, wherever that condition is not, we are sure that neither can the consequent be, and so may argue from the removal of the one to the removal of the other; as, on the contrary, wherever the consequent holds, it is certain that the condition must also take place; which shows, that by establishing the consequent, we at the same time establish the antecedent. But as it is a very particular case, and that happens but seldom, it cannot be extended into a general rule, and therefore affords not any steady and universal ground of reasoning upon the two foregoing suppositions.

SECTION VIII.

The manner of Arguing in Disjunctive Syllogisms.

As from the *major's* being a conditional proposition, we obtain the species of conditional syllogisms; so where it is a disjunctive proposition, the syllogism, to which it belongs, is called *disjunctive*, as in the following example:

The world is either self-existent, or the work of some finite or of some infinite being.
But it is not self-existent, nor the work of a finite being:
Therefore it is the work of an infinite being.

Now a disjunctive proposition is that where of several predicates we affirm one necessarily to belong to the subject, to the exclusion of all the rest, but leave that particular one undetermined. Hence it follows that as soon as we determine the particular predicate, all the rest are of course to be rejected; or if we reject all the predicates but one, that one necessarily takes place. When, therefore, in a *disjunctive* syllogism, the several predicates are enumerated in the *major*—if the *minor* establishes any one of these predicates, the conclusion ought to remove all the rest; or if, in the *minor*, all the predicates but one are removed, the conclusion must necessarily establish that one. Thus in the *disjunctive* syllogism given above, the *major* affirms one of three predicates to belong to the earth, viz. *self-existence*, or that it is *the work of a finite* or that it is *the work of an infinite being*. Two of these predicates are removed in the *minor*, viz. *self-existence*, and *the work of a finite being*. Hence the conclusion necessarily ascribes to it the third predicate, and affirms, that it is *the work of an infinite being*. If now we give the syllogism another turn, insomuch that the minor may establish one of the predicates by affirming the earth to be the *production of an infinite being*—then the conclusion must remove the other two, asserting it to be neither *self-existent*, nor *the work of a finite being*. These are the forms of reasoning in this species of syllogisms, the justness of which appears at first sight; and that there can be no other, is evident from the very nature of a disjunctive proposition.

SECTION IX.

Imperfect or mutilated Syllogisms.

In the several kinds of syllogisms hitherto mentioned, we may observe, that the parts are complete; that is, the three propositions of which they consist are represented in form. But it often happens, that some one of the premises is not only an evident truth, but also familiar, and in the minds of all men; in which case it is usually omitted, whereby we have an imperfect syllogism, that seems to be made up of only two propositions. Should we, for instance, argue in this manner:

> Every man is mortal:
> Therefore every king is mortal:

the syllogism appears to be imperfect, as consisting but of two propositions; yet it is really complete, only the *minor* [*every king is a man*] is omitted and left to the reader to supply, as being a proposition so familiar and evident, that it cannot escape him.

SECTION X.

Enthymemes.

These seemingly imperfect syllogisms are called *enthymemes*, and occur very frequently in reasoning, especially where it makes a part of common conversation. Nay, there is a particular elegance in them, because not displaying the argument in all its parts they leave somewhat to the exercise and invention of the mind. By this means we are put upon exerting ourselves, and seem to share in the discovery of what is proposed to us. Now, this is the great secret of fine writing, so to frame and put together our thoughts, as to give full play to the reader's imagination, and draw him insensibly into our very views and course of reasoning. This gives a pleasure not unlike to that which the author himself feels in composing. It besides shortens discourse, and adds a certain force and liveliness to our arguments, when the words in which they are conveyed, favour the natural quickness of the mind in its operations, and a single expression is left to exhibit a whole train of thoughts.

SECTION XI.

Ground of Reasoning in immediate Consequences.

But there is another species of reasoning with two propositions, which seems to be complete in itself, and where we admit the conclusion, without supposing any tacit or suppressed judgment in the mind, from which it follows sylogistically. This happens between propositions where the connexion is such, that the admission of the one, necessarily, and at the first sight implies the admission also of the other. For if it so falls out, that the proposition, on which the other depends, is self-evident, we content ourselves with barely affirming it, and infer that other by a direct conclusion. Thus, by admitting an universal proposition, we are forced also to admit of all the particular propositions comprehended under it, this being the very condition that constitutes a proposition universal. If then that universal proposition chances to be self-evident, the particular ones follow of course, without any farther train of reasoning. Whoever allows, for instance, *that things equal to one and the same thing are equal to one another*, must at the same time allow, *that two triangles, each equal to a square whose side is three inches, are also equal between themselves.* This argument therefore,

These equal to one and the same thing, are equal to one another;

Therefore those two triangles, each equal to the square of a line of three inches, are equal between themselves,

is complete in its kind, and contains all that is necessary towards a just and legitimate conclusion. For the first or universal proposition is self-evident, and therefore requires no farther proof. And as the truth of the particular is inseparably connected with that of the universal, it follows from it by an obvious and unavoidable consequence.

SECTION XII.

All reducible to Syllogisms of some one form or other.

Now in all cases of this kind, where propositions are deduced from one another, on account of a known and evident connexion, we are said to reason by *immediate consequence.* Such a coherence of propositions, manifest at first sight, and forcing itself upon the mind, frequently occurs in reasoning. Logicians have explained at some length, the several suppositions upon which it takes place, and allow of all *immediate consequences* that follow in conformity to them. It is, however, observable, that these, arguments though seemingly complete, because the conclusion follows necessarily from the single proposition that goes before, may yet be considered as real *enthymemes*, whose *major*, which is a conditional proposition, is wanting. The syllogism but just mentioned, when represented according to this view, will run as follows:

If things equal to one and the same thing are equal to one another; these two triangles, each equal to a square whose side is three inches, are also equal between themselves.

But things equal to one and the same thing, are equal to one another:

Therefore also these triangles, &c. are equal between themselves.

This observation will be found to hold in all immediate consequences whatsoever, insomuch that they are in fact no more than enthymemes of hypothetical syllogisms. But then it is particular to them, that the ground on which the conclusion rests, namely, its coherence with the minor, is of itself apparent, and seen immediately to flow from the rules and reasons of logic. As it is, therefore, entirely unnecessary to express a self-evident connexion, the major, whose office that is, is constantly omitted; nay, and seems so very little needful to enforce the conclusion, as to be accounted commonly no part of the argument at all. It must indeed be owned, that the foregoing immediate consequence might have been reduced to a simple, as well as an hypothetical syllogism, This will be evident to any one who gives himself the trouble to make the experiment. But it is not my design to enter farther into these niceties, what has been said sufficing to show that all arguments consisting of but two propositions, are real enthymemes, and reducible to complete syllogisms of some one form or other. As, therefore, the ground on which the conclusion rests, must needs be always the same with that of the syllogisms to which they belong, we have here an universal criterion, whereby at all times to ascertain the justness and validity of our reasonings in this way.

SECTION XIII.

A Sorites of plain simple Syllogisms.

The next species of reasoning we shall take notice of here, is what is commonly known by the name of a *sorites*. This is a way of arguing, in which a great number of propositions are so linked together, that the predicate of one becomes continually the subject of the next following, until at last a conclusion is formed, by bringing together the subject of the first proposition and the predicate of the last. Of this kind is the following argument:

God is omnipotent.
An omnipotent being can do every thing possible.
He that can do every thing possible, can do whatever involves not a contradiction.
Therefore God can do whatever involves not a contradiction.

This particular combination of propositions may be continued to any length we please, without in the least weakening the ground upon which the conclusion rests. The reason is, because the sorites itself may be resolved into as many simple syllogisms as there are middle terms in it; where this is found universally to hold, that when such a resolution is made, and the syllogisms are placed in train, the conclusion of the last in the series is also the conclusion of the sorites. This kind of argument, therefore, as it serves to unite several syllogisms into one, must stand upon the same foundation with the syllogisms of which it consists; and is, indeed, properly speaking, no other than a compendious way of reasoning syllogistically. Any one may be satisfied of this at pleasure, if he but takes the trouble of resolving the foregoing sorites into two distinct syllogisms. For he will there find, that he arrives at the same conclusion, and that too, by the very same train of thinking, but with abundantly more words, and the addition of two superfluous propositions.

SECTION XIV.

A Sorites of Hypothetical Syllogisms.

What is here said of plain simple propositions, may be well applied to those that are conditional; that is, any number of them may be so joined together in a series, that the consequent of one, shall become continually the antecedent of the next following; in which case, by establishing the antecedent of the first proposition, we establish the consequent of the last, or by removing the last consequent, remove also the first antecedent. This way of reasoning is exemplified in the following argument:

If we love any person, all emotions of hatred towards him cease.

If all emotions of hatred towards a person cease, we cannot rejoice in his misfortunes.

If we rejoice not in his misfortunes, we certainly wish him no injury.

Therefore if we love a person, we wish him no injury.

It is evident that this *sorites*, as well as the last, may be resolved into a *series* of distinct syllogisms, with this only difference, that here the syllogisms are all conditional. But as the conclusion of the last syllogism in the series is the same with the conclusion of the *sorites*, it is plain, that this also is a compendious way of reasoning, whose evidence arises from the evidence of the several single syllogisms into which it may be resolved.

SECTION XV.

The Ground of Reasoning by Induction.

I come now to that kind of argument, which logicians call *induction;* in order to the right understanding of which, it will be necessary to observe, that our general ideas are for the most part capable of various subdivisions. Thus the idea of the lowest species may be subdivided into its several individuals; the idea of any genus, into the different species it comprehends; and so of the rest. If then we suppose this distribution to be duly made, and so as to take in the whole extent of the idea to which it belongs; then it is plain, that all the subdivisions or parts of any idea taken together constitute that whole idea. Thus the several individuals of any species taken together constitute the whole species, and all the various species comprehended under any genus, make up the whole genus. This being allowed, it is apparent, that whatsoever may be affirmed of all the several subdivisions and classes of any idea, ought to be affirmed of the whole general idea to which these subdivisions belong. What may be affirmed of all the individuals of any species, may be affirmed of the whole species; and what may be affirmed of all the species of any genus, may also be affirmed of the whole genus; because, all the individuals, taken together, are the same with the species, and all the species taken together, the same with the genus.

SECTION XVI.

The Form and Structure of an Argument by Induction.

This way of arguing, where we infer universally concerning any idea, what we had before affirmed or denied separately, of all its several subdivisions and parts, is called reasoning by *induction*. Thus, if we suppose the whole tribe of animals, subdivided into men, beasts, birds, insects, and fishes, and then reason concerning them after this manner: *All men have a power of beginning motion; all beasts, birds, and insects, have a power of beginning motion; all fishes have a power of beginning motion: therefore all animals have a power of beginning motion;* The argument is an *induction*. When the subdvisions are just, so as to take in the whole general idea, and the enumeration is perfect, that is, extends to all and every of the inferior classes or parts; there the *induction* is complete, and the manner of reasoning by *induction* is apparently conclusive.

SECTION XVII.

The Ground of Argumentation in a Dilemma.

The last species of syllogisms I shall take notice of, in this chapter, is that commonly distinguished by the name of a *dilemma*. A *dilemma* is an argument by which we endeavour to prove the absurdity or falsehood of some assertion. In order to this we assume a conditional proposition; the antecedent of which is the assertion to be disproved, and the consequent a disjunctive proposition, enumerating all the possible suppositions upon which that assertion can take place. If then it appears, that all these several suppositions ought to be rejected, it is plain, that the antecedent, or assertion itself must be so too. When, therefore, such a proposition as that before mentioned, is made the *major* of any syllogism—if the *minor* rejects all the suppositions contained in the consequent, it follows necessarily, that the conclusion ought to reject the antecedent, which, as we have said, is the very assertion to be disproved. The particular way of arguing, is that which logicians call a *dilemma;* and from the account here given of it, it appears, that we may in general define it to be an *hypothetical syllogism, where the consequent of the major is a disjunctive proposition, which is wholly taken away or removed in the minor.* Of this kind is the following:

If God did not create the world perfect in its kind, it must either proceed from want of inclination, or from want of power:

But it could not proceed either from want of inclination, or from want of power.

Therefore he created the world perfect in its kind. *Or, which is the same thing:* 'Tis absurd to say that he did not create the world perfect in its kind.

SECTION XVIII.

An universal Description of it.

The nature then of a *dilemma* is universally this. The *major* is a conditional proposition, whose consequent contains all the several suppositions upon which the antecedent can take place. As therefore these suppositions are wholly removed in the *minor*, it is evident, that the antecedent must be so too; insomuch that we here always argue from the removal of the consequent to the removal of the antecedent. That is, a *dilemma* is an argument, in the *modus tollens* of hypothetical syllogisms, as logicians love to speak. Hence, it is plain, that if the antecedent of the *major* is an affirmative proposition, the conclusion of the *dilemma* will be negative; but if it be a negative proposition, the conclusion will be affirmative. I cannot dismiss the subject without observing, that as there is something very curious and entertaining in the structure of a *dilemma*, so is it a manner of reasoning that occurs frequently in mathematical demonstrations. Nothing is more common with *Euclid*, when about to show the equality of two given figures, or, which is the same thing, to prove the absurdity of asserting them unequal; nothing, I say, is more common with him, than to assume, *that if the one is not equal to the other, it must be either greater or less:* and having destroyed both these suppositions, upon which alone the assertion can stand, he thence very naturally infers, that the assertion itself is false. Now, this is precisely the reasoning of a *dilemma*, and in every step coincides with the frame and composition of that argument, as we have described it above.

CHAP. V.

OF DEMONSTRATION.

SECTION I.

Of Reasoning by a Concatenation of Syllogisms.

HAVING dispatched what seemed necessary to be said with regard to the forms of syllogisms, we now proceed to supply their use and application in reasoning. We have seen, that in all the different appearances they put on, we still arrive at a just and legitimate conclusion. Now, it often happens, that the conclusion of one syllogism becomes a previous proposition in another, by which means great numbers of them are sometimes linked together in a series, and truths are made to follow one another in train. And as in such a concatenation of syllogisms, all the various ways of reasoning that are truly conclusive, may be with safety introduced; hence it is plain, that in deducing any truth from its first principles, especially when it lies at a considerable distance from them, we are at liberty to combine all the several kinds of arguments above explained, according as they are found best to suit the end and purpose of our inquiries. When a proposition is thus, by means of syllogisms, collected from others more evident and known, it is said to be *proved;* so that we may in the general define *the* *proof of a proposition*, to be a syllogism, or series of syllogisms, collecting that proposition from known and evident truths. But more particularly, if the syllogisms, of which the proof consists, admit of no premises but definitions, self-evident truths, and propositions already established, then is the argument so constituted called a *demonstration;* whereby it appears, that demonstrations are ultimately founded on definitions and self-evident propositions.

SECTION II.

All Syllogisms whatsoever reducible to the first Figure.

But as a demonstration oft-times consists of a long chain of proofs, where all the various ways of arguing have place, and where the ground of evidence must of course be different in different parts, agreeably to the form of the argument made use of; it may not perhaps be unacceptable, if we here endeavour to reduce the evidence of demonstration to one simple principle, whence, as a sure and unalterable foundation, the certainty of it may in all cases be derived. In order to this we must first observe, that all syllogisms whatsoever, whether compound, multiform, or defective, are reducible to plain simple syllogisms in some one of the four figures. But this is not all. Syllogisms of the first figure in particular admit of all possible conclusions: that is, any proposition whatsoever, whether an universal affirmative, or universal negative, a particular affirmative or particular negative, (which four-fold division, as we have already demonstrated in the second part, embraces all their varieties) any one, I say, of these may be inferred, by virtue of some syllogism in the first figure. By this means it happens, that the syllogisms of all the other figures are reducible also to syllogisms of the first figure, and may be considered as standing on the same foundation with them. We cannot here demonstrate and explain the manner of this reduction, because it would too much swell the bulk of this treatise. It is enough to take notice that the thing is universally known and allowed among logicians, to whose writings we refer such as desire farther satisfaction in this matter. This then being laid down, it is plain, that any demonstration whatsoever may be considered as composed of a series of syllogisms, all in the first figure. For since all the syllogisms, that enter the demonstration, are reduced to syllogisms of some one of the four figures, and since the syllogisms of all the other figures are farther reducible to syllogisms of the first figure, it is evident, that the whole demonstration may be resolved into a series of these last syllogisms. Let us now, if possible, discover the ground upon which the conclusion rests, in syllogisms of the first figure; because, by so doing, we shall come at an universal principle of certainty, whence the evidence of all demonstrations, in all their parts, may be ultimately derived.

SECTION III.

The Ground of Reasoning in the first Figure.

The rules then of the first figure are briefly these. The *middle term* is the subject of the *major* proposition, and the predicate of the *minor*. The *major* is always an universal proposition, and the *minor* always affirmative. Let us now see what effect these rules will have in reasoning. The *major* is an universal proposition, of which the *middle term* is the subject, and the *predicate of the conclusion* the predicate. Hence it appears, that in the *major*, the *predicate of the conclusion* is always affirmed or denied universally of the *middle term*. Again, the *minor* is an affirmative proposition, whereof the *subject of the conclusion* is the subject, and the *middle term* the predicate. Here then the *middle term* is affirmed of *the subject of the conclusion*, that is, the *subject of the conclusion* is affirmed to be comprehended under, or to make a part of the *middle term*. Thus then we see what is done in the *premises* of a syllogism of the first figure. The *predicate of the conclusion* is universally affirmed or denied of some idea. The *subject of the conclusion* is affirmed to be, or to make a part of that idea. Hence it naturally and unavoidably follows, that the *predicate of the conclusion* ought to be affirmed or denied of the subject. To illustrate this by an example, we shall resume one of the syllogisms of the first chapter:

> Every creature possessed of reason and liberty, is accountable for his actions.
> Man is a creature possessed of reason and liberty :
> Therefore man is accountable for his actions.

Here, in the first proposition, the predicate of the conclusion, *accountableness*, is affirmed of all creatures that have reason and liberty. Again, in the second proposition, *man*, the subject of the conclusion, is affirmed to be, or to make a part of this class of creatures. Hence the conclusion necessarily and unavoidably follows, viz. *that man is accountable for his actions.* I say this follows necessarily and unavoidably. Because, if reason and liberty be that which constitutes a creature *accountable*, and *man* has reason and liberty, it is plain he has that which constitutes him *accountable*. In like manner, where the *major* is a negative proposition, or denies the *predicate of the conclusion* universally of the *middle term;* as the *minor* always asserts the *subject of the conclusion* to be or make a part of that *middle term*, it is no less evident that the *predicate of the conclusion* ought in this case to be denied of the *subject*. So that the ground of reasoning, in all syllogisms of the first figure is manifestly this : *Whatever may be affirmed universally of any idea may be affirmed of every or any number of particulars comprehended under that idea.* And again: *Whatever may be denied universally of any idea, may be in like manner denied of every or any number of its individuals.* These two propositions are called by logicians the *dictum de omni* and *dictum de nullo*, and are indeed the great principles of syllogistic reasoning; inasmuch as all conclusions whatsoever, either rest immediately upon them, or upon propositions deduced from them. But what adds greatly to their value is, that they are really self-evident truths, and such as we cannot gainsay, without running into an express contradiction. To affirm, for instance, *that no man is perfect*, and yet argue *that some men are perfect;* or to say that *all men are mortal*, and yet that *some men are not mortal*, is to assert a thing to be and not to be at the same time.

SECTION IV.

Demonstration, an Infallible Guide to Truth and Certainty.

And now I think we are sufficiently authorized to affirm, that in all syllogisms of the first figure, if the *premises* are true, the *conclusion* must needs be true. If it be true that the *predicate of the conclusion*, whether affirmative or negative, agrees universally to some idea—and if it be also true, that the *subject of the conclusion* is a part of or comprehended under that idea; then it necessarily follows, that the *predicate of the conclusion* agrees also to the *subject*. For to assert the contrary, would be to run counter to some one of the two principles before established; that is, it would be to maintain an evident contradiction. And thus we are come at last to the point we have been all along endeavouring to establish, namely, that every proposition, which can be demonstrated, is necessarily true. For as every demonstration may be resolved into a series of syllogisms, all in the first figure, and as in any one of these syllogisms, if the premises are true, the conclusion must needs be so too: it evidently follows, that if all the several premises are true, all the several conclusions are so, and consequently the conclusion also of the last syllogism, which is always the proposition to be demonstrated. Now that all the premises of a demonstration are true, will easily appear, from the very nature and definition of that form of reasoning. A demonstration, as we have said, is a series of syllogisms, all whose premises are either definitions, self-evident truths, or propositions already established. Definitions are identical propositions, wherein we connect the description of an idea with the name by which we choose to have that idea called; and therefore as to their truth there can be no dispute. Self-evident propositions appear true of themselves, and leave no doubt or uncertainty in the mind. Propositions before established, are no other than conclusions, gained by one or more steps from definitions and self-evident principles; that is, from true premises, and therefore must needs be true. Whence all the previous propositions of a demonstration, being, we see, manifestly true, the last conclusion, or proposition to be demonstrated, must be so too. So that demonstration not only leads to certain truth, but we have here a clear view of the ground and foundation of that certainty. For as in demonstrating, we may be said to do nothing more than combine a series of syllogisms together, all resting on the same bottom; it is plain, that one uniform ground of certainty runs through the whole, and that the conclusions are every where built upon some one of the two principles before established, as the foundation of all our reasoning. These two principles are easily reduced into one, and may be expressed thus: *Whatever predicate, whether affirmative or negative, agrees universally to any idea, the same must needs agree to every or any number of individuals comprehended under that idea.* And thus at length we have, according to our first design, reduced the certainty of demonstration to one simple and universal principle, which carries its own evidence along with it, and which is, indeed, the ultimate foundation of all syllogistic reasoning.

SECTION V.

The rules of Logic furnish a sufficient criterion for the distinguishing between Truth and Falsehood.

Demonstration, therefore, serving as an infallible guide to truth, and standing on so sure and unalterable a basis, we may now venture to assert, what I doubt not will appear a paradox to many, namely, that the rules of logic furnish a sufficient criterion for the distinguishing between truth and falsehood. For since every proposition that can be demonstrated is necessarily true, he is able to distinguish truth from falsehood, who can with certainty judge when a proposition is duly demonstrated. Now a demonstration is, as we have said, nothing more than a concatenation of syllogisms, all whose premises are definitions, self-evident truths, or propositions previously established. To judge, therefore, of the validity of a demonstration, we must be able to distinguish whether the definitions that enter it are genuine, and truly descriptive of the ideas they are meant to exhibit; whether the propositions assumed without proof as intuitive truths, have really that self-evidence to which they lay claim; whether the syllogisms are drawn up in due form, and agreeable to the laws of argumentation; in fine, whether they are combined together in a just and orderly manner, so that no demonstrable propositions serve any where as premises, unless they are conclusions of previous syllogisms. Now it is the business of logic in explaining the several operations of the mind, fully to instruct us in all these points. It teaches the nature and end of definitions, and lays down the rules by which they ought to be framed. It unfolds the several species of propositions, and distinguishes the self-evident from the demonstrable. It delineates also the different forms of syllogisms, and explains the laws of argumentation proper to each. In fine, it describes the manner of combining syllogisms, so as that they may form a train of reasoning, and lead to the successive discovery of truth. The precepts of logic, therefore, as they enable us to judge with certainty, when a proposition is duly demonstrated, furnish a sure criterion for distinguishing between truth and falsehood.

SECTION VI.

And extending to all Cases where a certain Knowledge of Truth is attainable.

But perhaps it may be objected, that demonstration is a thing very rare and uncommon, as being the prerogative of but a few sciences, and therefore the criterion here given can be of no great use. I answer that wherever by the bare contemplation of our ideas, truth is discoverable, there also demonstration may be obtained. Now that I think is an abundantly sufficient criterion, which enables us to judge with certainty, in all cases where the knowledge of truth comes within our reach; for with discoveries that lie beyond the limits of the human mind, we have properly no business nor concernment. When a proposition is demonstrated, we are certain of its truth. When, on the contrary, our ideas are such as have no visible connexion or repugnance, and therefore furnish not the proper means of tracing their agreement or disagreement, there we are sure that knowledge, scientifical knowledge I mean, is not attainable. But where there is some foundation of reasoning, which yet amounts not to the full evidence of demonstration, there the precepts of logic, by teaching us to determine aright of the degree of proof, and of what is still wanting to render it full and complete, enable us to make a due estimate of the measures, of probability, and to proportion our assent to the grounds on which the proposition stands. And this is all we can possibly arrive at, or even so much as hope for, in the exercise of faculties so imperfect and limited as ours. For it were the height of folly, to expect a *criterion* that should enable us to distinguish truth from falsehood, in cases where a certain knowledge of truth is not attainable.

SECTION VII.

The Distinction of Demonstration into direct and indirect.

We have now done with what regards the ground and evidence of demonstration; but before we conclude this chapter, it may not be improper to take notice of the distinction of it into *direct* and *indirect*. A *direct demonstration* is when beginning with definitions, self-evident propositions, or known and allowed truths, we form a train of syllogisms, and combine them in an orderly manner, continuing the series through a variety of successive steps, until at last we arrive at a syllogism, whose conclusion is the proposition to be demonstrated. Proofs of this kind leave no doubt or uncertainty behind them; because all the several premises being true, the conclusion, must be so too, and of course the very last conclusion, or proposition to be proved. I shall not therefore, any farther enlarge upon this method of demonstrating; having, I hope, sufficiently explained it in the foregoing part of this chapter, and shown wherein the force and validity of it lies. The other species of demonstration is the *indirect*, or as it is sometimes called, the *apological*. The manner of proceeding here is, by assuming a proposition which directly contradicts that we mean to demonstrate, and thence by a continued train of reasoning, in the way of a direct demonstration, deducing some absurdity or manifest untruth. For hereupon we conclude that the proposition assumed was false, and thence again, by an immediate consequence, that the proposition to be demonstrated is true. Thus *Euclid*, in his third book, being to demonstrate, *that circles which touch one another inwardly have not the same centre;* assumes the direct contrary to this, viz. *that they have the same centre;* and hence by an evident train of reasoning, proves, *that a part is equal to the whole.* The supposition therefore leading to the absurdity he concludes to be false, viz. *that circles touching one another inwardly have the same centre*, and thence again immediately infers, *that they have not the same centre.*

SECTION VIII.

Ground of Reasoning in indirect Demonstrations.

Now because this manner of demonstration is accounted by some not altogether so clear and satisfactory, nor to come up to that full degree of evidence which we meet with in the direct way of proof; I shall, therefore, endeavour here to give a particular illustration of it, and to show that it equally with the other leads to truth and certainty. In order to this, we must observe, that two propositions are said to be *contradictory* one of another, when that which is asserted to be in the one, is asserted not to be in the other. Thus the propositions—*circles that touch one another inwardly have the same centre*—and *circles that touch one another inwardly have not the same centre*—are *contradictories;* because the second asserts the direct contrary of what is asserted in the first. Now in all contradictory propositions, this holds universally, that one of them is necessarily true, and the other necessarily false. For if it be true, that circles which touch one another inwardly have not the same centre, it is unavoidably false that they have the same centre. On the other hand, if it be false that they have the same centre, it is necessarily true that they have not the same centre. Since, therefore, it is impossible for them to be both true or both false at the same time, it unavoidably follows, that one is necessarily true, and the other necessarily false. This then being allowed, which is indeed self-evident, if any two contradictory propositions are assumed, and one of them can by a clear train of reasoning be demonstrated to be false, it necessarily follows that the other is true. For as the one is necessarily true, and the other necessarily false, when we come to discover which is the false. proposition, we thereby also know the other to be true.

SECTION IX.

Indirect Demonstrations a sure Guide to Certainty.

Now this is precisely the manner of an indirect demonstration, as is evident from the account given of it above. For there we assume a proposition which directly contradicts that we mean to demonstrate, and having, by a continued series of proofs, shown it to be false, thence infer that its contradictory, or the proposition to be demonstrated, is true. As therefore this last conclusion is certain and unavoidable, let us next inquire, after what manner we come to be satisfied of the falsehood of the assumed proposition, that so no possible doubt may remain, as to the force and validity of demonstrations of this kind. The manner, then, is plainly this: Beginning with the assumed proposition, we, by the help of definitions, self-evident truths, or propositions already established, continue a series of reasoning, in the way of a direct demonstration, until at length we arrive at some absurdity or known falsehood. Thus *Euclid*, in the example before mentioned, from the supposition that circles touching one another inwardly have the same centre, deduces, *that a part is equal to the whole*. Since, therefore, by a due and orderly process of reasoning, we come at last to a false conclusion, it is manifest that all the premises cannot be true. For were all the premises true, the last conclusion must be so too, by what has been before demonstrated. Now, as to all the other premises made use of in the courseof reasoning, they are manifest and known truths by supposition, as being either definitions, self-evident propositions, or truths established. The assumed proposition is that only as to which any doubt or uncertainty remains. That alone, therefore, can be false, and indeed, from what has been already shown, must unavoidably be so. And thus we see, that in indirect demonstrations, two contradictory propositions being laid down, one of which is demonstrated to be false, the other, which is always the proposition to be proved, must necessarily be true; so that here, as well as in the direct way of proof, we arrive at a clear and satisfactory knowledge of truth.

SECTION X.

A particular Case of Indirect Demonstration.

This is universally the method of reasoning in all apological or indirect demonstrations; but there is one particular case, which has something so singular and curious in it, that well deserves to be méntioned by itself; more especially, as the ground on which the conclusion rests will require some farther illustration. It is, in short, this: that if any proposition is assumed, from which, in a direct train of reasoning, we can deduce its contradictory, the proposition so assumed is false, and the contradictory one true. For if we suppose the assumed proposition to be true, then, since all the other premises that enter the demonstration are also true, we shall have a series of reasoning, consisting wholly of true premises; whence the last conclusion, or contradictory of the assumed proposition, must be true likewise. So that by this means we should have two contradictory propositions both true at the same time, which is manifestly impossible. The assumed proposition, therefore, whence this absurdity flows, must necessarily be false, and consequently its contradictory, which is here the proposition deduced from it, must be true. If then any proposition is proposed to be demonstrated, and we *assume* the *contradictory* of that proposition, and thence directly infer the proposition to be demonstrated, by this very means we know that the proposition so inferred is true. For since from an assumed proposition we have deduced its contradictory, we are thereby certain that the assumed proposition is false; and if so, then its contradictory, or that deduced from it, which in this case is the same with the proposition to be demonstrated, must be true.

SECTION XI.

A due knowledge of the Principles of Logic indispensably necessary to make us proper Judges of Demonstration;

That this is not a mere empty speculation, void of all use and application in practice, is evident from the conduct of the mathematicians, who have adopted this manner of reasoning, and given it a place among their demonstrations. We have a curious instance of it in the twelfth proposition of the ninth book of the elements. *Euclid* there proposes to demonstrate, *that in any series of numbers, arising from unity in geometrical progression, all the prime numbers that measure the last term in the series, will also measure the next after unity.* In order, to this, he assumes the contradictory of the proposition to be demonstrated, namely; *that some prime number measuring the last term in the series, does not measure the next after unity*, and thence by a continued train of reasoning proves, that it actually does measure it. Hereupon he concludes the assumed proposition to be false, and that which is deduced from it or its contradictory, which is the very proposition he proposed to demonstrate, to be true. Now, that this is a just and conclusive way of reasoning, is abundantly manifest, from what we have so clearly established above. I would only here observe, how necessary some knowledge of the rules of logic is, to enable us to judge of the force, justness, and validity of demonstrations; since such may sometimes occur, where the truth of the proposition demonstrated will neither be owned nor perceived, unless we know beforehand, by means of logic, that a conclusion so deduced, is necessarily true and valid. For though it be readily allowed, that by the mere strength of our natural faculties, we can at once discern, that of two contradictory propositions, the one is necessarily true, and the other necessarily false: yet, when they are so linked together in a demonstration, as that the one serves as a previous proposition, whence the other is deduced; it does not so immediately appear, without some knowledge of the principles of logic, why that alone, which is collected by reasoning, ought to be embraced as true, and the other, whence it is collected, to be rejected as false.

SECTION XII.

And of itself sufficient to guard us against Error and false Reasoning.

Having thus, I hope, sufficiently evinced the certainty of demonstration in all its branches, and shown the rules by which we ought to proceed, in order to arrive at a just conclusion, according to the various ways of arguing made use of; I hold it needless to enter upon a particu-
consideration of those several species of false reason-
which logicians distinguish by the name of *sophisms*.

He that thoroughly understands the form and structure of a good argument, will of himself readily discern every deviation from it. And although *sophisms* have been divided into many classes, which are all called by sounding names, that therefore carry in them much appearance of learning; yet are the errors themselves so very palpable and obvious, that I should think it lost labour to write for a man capable of being misled by them. Here, therefore, we choose to conclude this third part of logic, and shall in the next book give some account of *method*, which, though inseparable from reasoning, is nevertheless always considered by logicians as a distinct operation of the mind; because its influence is not confined to the mere exercise of the reasoning faculty, but extends in some degree to all the transactions of the understanding.

BOOK IV.

Of Method.

CHAP. I.

OF METHOD IN GENERAL AND THE DIVISION OF IT INTO ANALYTIC AND SYNTHETIC.

SECTION I.

The Understanding sometimes employed in putting together known Truths.

WE have now done with the three first operations of the mind, whose office it is to search after truth, and enlarge the bounds of human knowledge. There is yet a fourth which regards the disposal and arrangement of our thoughts, when we endeavour so to put them together, that their mutual connexion and dependence may be clearly seen. This is what logicians call *method*, and place always the last in order, in explaining the powers of the understanding; because it necessarily supposes a previous exercise of our other faculties, and some progress made in knowledge, before we can exert it in any extensive degree. It often happens, in the pursuit of truth, that unexpected discoveries present themselves to the mind, and those, too, relating to subjects very remote from that about which we are at present employed. Even the subjects themselves of our inquiry, are not always chosen with a due regard to order, and their dependence one upon another. Chance, our particular way of life, or some present and pressing views, often prompt us to a variety of researches, that have but little connexion in the nature of things. When, therefore a man accustomed to much thinking, comes, after any considerable interval of time, to take a survey of his intellectual acquisitions, he seldom finds reason to be satisfied with that order and disposition, according to which they made their entrance into his understanding. They are there dispersed and scattered, without subordination, or any just and regular coherence; insomuch that the subserviency of one truth to the discovery of another, does not so readily appear to the mind. Hence he is convinced of the necessity of distributing them into various classes, and combining into an uniform system whatever relates to one and the same subject. Now this is the true and proper business of *method;* to ascertain the various divisions of human knowledge, and so to adjust and connect the parts in every branch, that they may seem to grow one out of another, and form a regular body of science, rising from first principles, and proceeding by an orderly concatenation of truths.

SECTION II.

Sometimes in the Search and Discovery of such as are unknown.

In this view of things, it is plain, that we must be before-hand well acquainted with the truths we are to combine together; otherwise how could we discern their several connexions and relations, or so dispose of them as their mutual dependence may require? But now it often happens, the understanding is employed, not in the arrangement and composition of known truths, but in the search and discovery of such as are unknown. And here the manner of proceeding is very different, inasmuch as we assemble at once our whole stock of knowledge relating to any subject, and, after a general survey of things, begin with examining them separately and by parts. Hence it comes to pass, that whereas at our first setting out, we were acquainted only with some of the grand strokes and outlines, if I may so say, of truth, by thus pursuing her through her several windings and recesses, we gradually discover those more inward and finer touches, whence she derives all her strength, symm and beauty. And here it is, that when, by a narrow scrutiny into things, we have unravelled any part of knowledge, and traced it to its first and original principles, insomuch that the whole frame and contexture of it lies open to the view of the mind; here, I say, it is, that, taking it the contrary way, and beginning with these principles, we can so adjust and put together the parts, as the order and method of science requires.

SECTION III.

Illustrated by the Similitude of a Watch.

But as these things are best understood when illustrated by examples, especially if they are obvious and taken from common life; let us suppose any machine, for instance, a watch, presented to us, whose structure and composition we are as yet unacquainted with, but want, if possible, to discover. The manner of proceeding, in this case, is by taking the whole to pieces, and examining the parts separately one after another. When by such a scrutiny we have thoroughly informed ourselves of the frame and contexture of each, we then compare them together, in order to judge of their mutual action and influence.. By this means we gradually trace out the inward make and composition of the whole, and come at length to discern, how parts of such a form, and so put together as we found, in unravelling and taking them asunder, constitute that particular machine called a watch, and contribute to all the several motions and phenomena observable in it. This discovery being made, we can take things the contrary way, and, beginning with the parts, so dispose and connect them, as their several uses and structures require, until at length we arrive at the whole itself, from the unravelling of which these parts resulted.

SECTION IV.

Ground of the Analytic and Synthetic Methods.

And, as it is in tracing and examining the works of art, so it is in a great measure in unfolding any part of human knowledge. For the relations and mutual habitudes of things, do not always immediately appear, upon comparing them one with another. Hence we have recourse to intermediate ideas, and, by means of them, are furnished with those previous propositions that lead to the conclusion we are in quest of. And if it so happen, that the previous propositions themselves are not sufficiently evident, we endeavour, by new middle terms, to ascertain their truth, still tracing things backward in a continued series, until at length we arrive at some syllogism, where the premises are first and self-evident principles. This done, we become perfectly satisfied as to the truth of all the conclusions we have passed through, inasmuch as they are now seen to stand upon the firm and immovable foundation of our intuitive perceptions. And as we arrived at this certainty, by tracing things backward to the original principles whence they flow, so may we at any time renew it by a direct contrary process, if, beginning with these principles, we carry the train of our thoughts forward, until they lead us, by a connected chain of proofs, to the very last conclusion of the series.

SECTION V.

Division of Method into Analytic and Synthetic.

Hence it appears, that in disposing and putting together our thoughts, either for our own use, that the discoveries we have made may at all times lie open to the review of the mind; or, where we mean to communicate and unfold these discoveries to others, there are two ways of proceeding equally within our choice. For we may so propose the truths relating to any part of knowledge, as they presented themselves to the mind in the manner of investigation, carrying on the series of proofs in a reverse order, until they at last terminate in first principles: or beginning with these principles, we take the contrary way, and from them deduce, by a direct train of reasoning, all the several propositions we want to establish. This diversity in the manner of arranging our thoughts gives rise to the two-fold division of method established among logicians. For method, according to their use of the word, is nothing else but the order and disposition of our thoughts relating to any subject. When truths are so proposed and put together, as they were or might have been discovered, this is called the *analytic method*, or the *method of resolution*; inasmuch as it traces things backward to their source, and *resolves* knowledge into its first and original principle. When, on the other hand, they are deduced from these principles, and connected according to their mutual dependence, insomuch that the truths first in order tend always to the demonstration of those that follow, this constitutes what we call the *synthetic method*, or *method of composition*. For here we proceed by gathering together several scattered parts of knowledge, and *combining* them into one whole, or system, in such manner, that the understanding is enabled distinctly to follow truth through all her different stages and gradations.

SECTION VI.

Called otherwise the Method of Invention and the Method of Science.

There is farther to be taken notice of, in relation to these two species of method; that the first has also obtained the name of the *method of invention*, because it observes the order in which our thoughts succeed one another, in the invention or discovery of truth. The other, again is often denominated the *method of doctrine*, or instruction, inasmuch as in laying our thoughts before others, we generally choose to proceed in the synthetic manner, deducing them from their first principles. For we are to observe, that although there is great pleasure in pursuing truth in the method of investigation, because it places us in the condition of the inventor, and shews the particular train and process of thinking by which he arrived at his discoveries; yet it is not so well accommodated to the purposes of evidence and conviction. For at our first setting out, we are commonly unable to divine where the analysis will lead us; inasmuch that our researches are for some time little better than a mere groping in the dark. And even after light begins to break in upon us, we are still obliged to many reviews, and a frequent comparison of the several steps of the investigation among themselves. Nay, when we have unravelled the whole, and reached the very foundation on which our discoveries stand, all our certainty, in regard to their truth, will be found in a great measure to arise from that connexion we are now able to discern between them and first principles, taken in the order of composition. But in the synthetic manner of disposing our thoughts, the case is quite different. For as we here begin with intuitive truths, and advance by regular deductions from them, every step of the procedure brings evidence and conviction along with it; so that in our progress from one part of knowledge to another, we have always a clear perception of the ground on which our assent rests. In communicating, therefore, our discoveries to others, this method is apparently to be chosen, as it wonderfully improves and enlightens the understanding, and leads to an immediate perception of truth. And hence it is, that in the following pages, we choose to distinguish it by the name of the *method of science;* not only as in the use of it we arrive at *science* and certainty, but because it is in fact the method, in which all those parts of human knowledge, that properly bear the name of *science*, are and ought to be delivered. But we now proceed to explain these two kinds of method more particularly.

CHAP. II.

OF THE METHOD OF INVENTION.

SECTION I.

Origin of the several Arts and Inventions of Human Life.

By the *method of invention* we understand such a disposition and arrangement of our thoughts, as follows the natural procedure of the understanding, and presents them in the order in which they succeed one another, in the investigation and discovery of truth. Now it is plain, that to handle a subject successfully according to this method, we have no more to do than observe the several steps and advances of our minds, and fairly copy them out to the view of others. And, indeed, it will be found to hold in general, with regard to all the active parts of human life, especially when reduced to that which is in the schools termed an art; that the rules, by which we conduct ourselves, are no other than a series of observations drawn from the attention of the mind to what passes, while we exercise our faculties in that particular way. For when we set about any invention or discovery, we are always pushed on by some inward principle, disposition, or aptitude shall I call it, which we experience in ourselves, and which makes us believe, that the thing we are in quest of, is not altogether beyond our reach. We therefore begin with essaying our strength, and are sometimes successful, though perhaps more frequently not. But as the mind, when earnestly bent upon any pursuit, is not easily discouraged by a few disappointments, we are only set upon renewing our endeavours, and, by an obstinate perseverance, and repeated trials, often arrive at the discovery of what we have in view. Now it is natural for a man of a curious and inquisitive turn, after having mastered any part of knowledge with great labour and difficulty, to set himself to examine how he happened to miscarry in his first attempts, and by what particular method of procedure he at length came to be successful. By this means we discover on the one hand, those rocks and shelves which stand most in our way, and are apt to disturb and check our progress; and on the other, that more sure and certain course, which if we continue in steadily, will bring us to the attainment of what we are in pursuit of. Hence spring all the arts and inventions of human life, which, as we have already said, are founded upon a series of rules and observations, pointing out the true and genuine manner of arriving at any attainment. When the mind rests satisfied in a bare contemplation of the rules, and the reasons on which they are founded, this kind of knowledge is called speculative. But if we proceed farther, and endeavour to apply these rules to practice, so as to acquire a habit of exerting them on all proper occasions, we are then said to be possessed of the art itself.

SECTION II.

Why in treating of the Method of Invention, we must give some Account of the Art itself.

From what has been said, it appears, that, in order distinctly to explain the method of invention, we must take a view of the understanding, as employed in the search and investigation of truth. For by duly attending to its procedure and advances, we shall not only discover the rules by which it conducts itself, but be enabled also to trace out the several helps and contrivances it makes use of, for the more speedy and effectual attainment of its ends. And when these particulars are once known, it will not be difficult for us, in laying open our discoveries to others, to combine our thoughts agreeably to the method here required. Because, having fixed and ascertained the rules of it, and being perfectly acquainted with the conduct and manner of the mind, we need only take a view of the several truths, as they succeed one another in the series of investigation, set them in order before us, and fairly transcribe the appearance they make to the understanding. Hence it is, that logicians, in treating of the method of invention, have not merely confined themselves to the laying down of directions for the disposal and arrangements of our thoughts; but have rather explained the art itself, and established those rules by which the mind ought to proceed in the exercise of its inventive powers. For they rightly judge, that if these were thoroughly understood, the other could no longer remain unknown. By this means it happens, that the method of invention is become another expression for the *art of invention*, and very often denotes the conduct and procedure of the understanding in the search of truth. And as some knowledge of the principles of the art, is in a manner absolutely necessary towards a true conception of the rules by which we ought to govern and dispose our thoughts in treating subjects after this method; we shall, therefore, follow the example of other logicians, and endeavor to give some short account of the business of invention, and of those several helps and contrivances by which the mind is enabled to facilitate and enlarge its discoveries.

SECTION III.

Attention and a comprehensive Understanding, the preparatory Qualifications to invention.

It has been already observed, that when the mind employs itself in the search of unknown truth, it begins with assembling at once its whole stock of knowledge relating to the subject, and after a general survey of things, sets about examining them separately and by parts. Now as in this separate examination, the number of parts continually increase upon us—and as it is farther necessary, that we survey them on all sides, compare them one with another, and accurately trace their mutual habitudes and respects—it is from hence apparent, that in the exercise of invention, two things are of principal consideration. First, an enlarged and comprehensive understanding, able to take in the great multitude of particulars, that frequently come under our notice. Secondly, a strong habit of attention, that lets nothing remarkable slip its view, and distinguishes carefully all those circumstances which tend to the illustrating and clearing the subject we are upon. These are the great and preparatory qualifications, without which it were vain to hope, that any considerable advance could be made in enlarging the bounds of human knowledge. Nor ought we to esteem it a small advantage, that they are in some measure in our own power, and may, by a proper cultivation, be improved and strengthened to a degree almost beyond belief. We find by experience, that the study of mathematics in particular is greatly serviceable to this end. Habits we all know, grow stronger by exercise; and as in this science there is a perpetual call upon our attention, it by degrees becomes natural to us, so as that we can preserve it steady and uniform through long and intricate calculations, and that with little or no fatigue to the understanding. But a yet more wonderful advantage, arising from the culture of the mathematics, is this, that hereby we in some measure extend the dimensions of the human mind, enlarge its compass of perception, and accustom it to wide and comprehensive views of things. For whereas at our first setting out, we often find it extremely difficult to master a short and easy demonstration, and trace the connexion of its several parts; yet as we advance in the science, the understanding is seen gradually to dilate, and stretch itself to a greater size; insomuch that a long and intricate series of reasoning is often taken in with scarce any labour of thought; and not only so, but we can in some cases, with a single glance of our minds, run through an entire system of truths, and extend our view at once to all the several links that unite and hold them together.

SECTION IV.

Judicious choice of intermediate Ideas another great Requisite in this Art.

When we are furnished with these two preparatory qualifications, the next requisite to the discovery of truth is, a judicious choice of intermediate ideas. We have seen in the third part of this treatise, that many of our ideas are of such a nature as not to discover these several habitudes and relations by an immediate comparison one with another. In this case, we must have recourse to intermediate ideas; and the great art lies in finding out such as have an obvious and perceivable connexion with the ideas whose relations we inquire after. For thus it is, that we are furnished with known and evident truths, to serve as premises for the discovery of such as are unknown. And indeed the whole business of invention seems in a great measure, to lie in the due assemblage and disposition of these preliminary truths. For they not only lead us, step by step, to the discovery we are in quest of, but are so absolutely necessary in the case, that without them it were vain to attempt it; nothing being more certain, than that unknown propositions can no otherwise be traced but by means of some connexion they have with such as are known. Nay, reason itself, which is indeed the art of knowledge, and the faculty by which we push on our discoveries; yet by the very definition of it implies no more, than an ability of deducing unknown truths from principles or propositions that are already known. Now, although this happy choice of intermediate ideas, so as to furnish a due train of previous propositions, that shall lead us successively from one discovery to another, depends in some measure upon a natural sagacity and quickness of mind; it is yet certain, from experience, that even here much may be effected by a stubborn application and industry. In order to this, it is in the first place necessary that we have an extensive knowledge of things, and some general acquaintance with the whole circle of the arts and sciences. Wide and extended views add great force and penetration to the mind, and enlarge its capacity of judging. And if to this we join, in the second place, a more particular and intimate study of whatever relates to the subject about which our inquiries are employed, we seem to bid fair for success in our attempts. For thus we are provided with an ample variety out of which to choose our intermediate ideas, and are therefore more likely to discover some among them that will furnish out the previous propositions necessary in any train of reasoning.

SECTION V.

Sagacity and a quickness of Understanding greatly promoted by the Study of Algebra.

It is not, indeed to be denied, that when we have even got all our materials about us, much still depends upon a certain dexterity and address, in singling out the most proper, and applying them skilfully for the discovery of truth. This is the talent which is known by the name of sagacity, and commonly supposed to be altogether the gift of nature. But yet I think it is beyond dispute, that practice, experience, and a watchful attention to the procedure of our own minds, while employed in the exercise of reasoning, are even here of very great avail. It is a truth well known to those who have made any considerable progress in the study of algebra, that an address and skill in managing intricate questions may be very often obtained, by a careful imitation of the best models. For although when we first set out about the solution of equations, we are puzzled at every step, and th [illegible] came never enough admire the sagacity of those wh [illegible] ogres- us with elegant models in that way; yet by deg [illegible] it as- ourselves arrive at a great mastery, not only in de [illegible] nd as it proper equations, and coupling them artfully [illegible] great ease so as from the more complicated to derive others, all the are simple; but also in contriving useful substitutions, of to free our calculations from fractions, and those intricacies that arise from surds and irratational quantities. Nor is it a small pleasure attending the prosecution of this study, that we thus discern the growing strength of our minds, and see ourselves approaching nearer and nearer to that sagacity and quickness of understanding which we see so much admired in others, and were at first apt to conclude altogether beyond our reach.

SECTION VI.

Where Art and Management are required in the business of Invention.

We have now considered those requisites to invention, that have their foundation in the natural talents of the mind: an enlarged and comprehensive understanding, a strong habit of attention, a sagacity and quickness in discerning and applying intermediate ideas. Let us next take a view of such other helps, as more immediately depend upon art and management, and show the address of the mind, in contriving means to facilitate its discoveries, and free it from all unnecessary fatigue and labour. For we are to observe that though the capacity of the intellect may be greatly enlarged by use and exercise, yet still our views are confined within certain bounds, beyond which a finite understanding cannot reach. And as it often happens, in the investigation of truth, especially where it lies at a considerable distance from first principles, that the number of connexions and relations are so great, as not to be taken in at once by the most improved understanding; it is therefore one great branch of the art of invention, to take account of these relations, as they come into view, and dispose them in such manner, [illegible]y always lie open to the inspection of the mind, [illegible] disposed to turn its attention that way. By this [illegible]s, without perplexing ourselves with too many con[illegible]ons at once, we have yet these relations at com[illegible], when necessary to be taken notice of in the prosecution of our discoveries: and the understanding thus free and disengaged, can bend its powers more intensely towards that particular part of the investigation it is at present concerned with. Now in this, according to my apprehension, lies the great art of human knowledge; to manage with skill the capacity of the intellect, and contrive such helps as may bring the most wide and extended objects within the compass of its natural powers. When, therefore, the multitude of relations increase very fast upon us, and grow too unwieldly to be dealt with in the lump, we must combine them in different classes, and so dispose of the several parts, as that they may at all times lie open to the leisurely survey of the mind. By this means we avoid perplexity and confusion, and are enabled to conduct our researches without being puzzled with that infinite crowd of particulars, that frequently fall under our notice in long and difficult investigations. For by carrying our attention successively from one part to another, we can upon occasion take in the whole; and knowing also the order and disposition of the parts, may have recourse to any of them at pleasure, when its aid becomes necessary in the course of our inquiries.

SECTION VII.

An orderly Disposition of great use in adapting Objects to the Capacity of the Understanding;

First, then, I say, that an orderly combination of things and classing them together with art and address, brings great and otherwise unmanageable objects, upon a level with the powers of the mind. We have seen in the first part of this treatise, how by taking numbers in a progressive series, and according to an uniform law of composition, the most bulky and formidable collections are comprehended with ease, and leave distinct impressions in the understanding. For the several stages of the progression serve as so many steps to the mind by which it ascends gradually to the highest combinations; and as it can carry its views from one to another, with great ease and expedition, it is thence enabled to run over all the parts separately, and thereby rise to a just conception of the whole. The same thing happens in all our other complex notions, especially when they grow very large and complicated; for then it is that we become sensible of the necessity of establishing a certain order and gradation in the manner of combining the parts. This has been already explained, at some length, in the chapter of the composition and resolution of our ideas; where we have traced the gradual progress of the mind through all the different orders of perception, and shown, that the most expeditious way of arriving at a just knowledge of the more compounded notices of the understanding, is by advancing regularly through all the intermediate steps. Hence it is easy to perceive what advantages must arise from a like conduct in regard to those several relations and connexions, upon which the investigation of truth depends. For as by this means we are enabled to bring them all within the reach of the mind, they can each in their turns be made use of upon occasion, and furnish their assistance towards the discovery of what we are in quest of. Now this is of principal consideration in the business of invention, to have our thoughts so much under command, that, in comparing things together, in order to discover the result of their mutual connexions and dependence, all the several lights that tend to the clearing the subject we are upon, may lay distinctly open to the understanding, so as nothing material shall escape its view: because an oversight of this kind, in summing up the account, must not only greatly retard its advances, but in many cases check its progress altogether.

SECTION VIII.

And enabling us to proceed gradually, and with ease, in the Investigation of Truth.

But, secondly, another advantage arising from this orderly disposition, is, that hereby we free the mind from all unnecessary fatigue, and leave it to fix its attention upon any part separately, without perplexing itself with the consideration of the whole. Unknown truths, as we have already observed, are only to be traced by means of the relation between them and others that are known. When, therefore, these relations become very numerous, it must needs greatly distract the mind, were it to have its attention continually upon the stretch after such a multitude of particulars at once. But now, by the method of classing and ordering our perceptions above explained, this inconvenience is wholly prevented. For a just distribution of things, as it ascertains distinctly the place of each, enables us to call any of them into view at pleasure, when the present consideration of it becomes necessary. Hence the mind proceeding gradually through the several relations of its ideas, and marking the results of them at every step, can always proportion its inquiries to its strength; and confining itself to such a number of objects as it can take in and manage with ease, sees more distinctly all the consequences that arise from comparing them one with another. When, therefore it comes afterwards to take a review of these its several advances, as by this means the amount of every step of the investigation is fairly laid open to its inspection, by adjusting and putting these together, in due order and method, it is enabled at last to discern the result of the whole. And thus, as before, in the composition of our ideas, so likewise here in the search and discovery of truth, we are fain to proceed gradually, and by a series of successive stages. For these are so many resting places to the mind, whence to look about it, survey the conclusions it has already gained, and see what helps they afford, towards the obtaining of others which it must still pass through, before it reaches the end of the investigation. Hence it often happens, that very remote and distant truths, which lie far beyond the reach of any single effort of the mind, are yet, by this progressive method, successively brought to light, and that too with less fatigue to the understanding than could at first have well been imagined. For although the whole process, taken together, is frequently much too large to come within the view of the mind at once; and therefore, considered in that light, may be said truly to exceed its grasp; yet the several steps of the investigation by themselves are often easy and manageable enough, so that by proceeding gradually from one to another, and thoroughly mastering the parts as we advance, we carry on our researches with wondrous dispatch, and are at length conducted to that very truth, with a view to the discovery of which the inquisition itself was set on foot.

SECTION IX.

Algebra and Arithmetic, properly speaking, both Arts of Invention.

But now perhaps it may not be improper, if we endeavour to illustrate these observations by an example, and set ourselves to trace the conduct and manner of the mind, when employed in the exercise of invention. There are two great branches of the mathematics peculiarly fitted to furnish us with models in this way. *Arithmetic*, I mean, and *Algebra*. Algebra is universally known to be the very art and principle of invention; and in arithmetic, too, we are frequently put upon the finding out of unknown numbers, by means of their relations and connexions with others that are known: as where it is required to find a number equal to this sum of two others, or the product of two others. I choose to borrow my examples chiefly from this last science, both because they will be more within the reach of those for whom this treatise is principally designed; as likewise, because arithmetic furnishes the best models of a happy sagacity and management, in classing and regulating our perceptions. So that here, more than in any other branch of human knowledge, we shall have an opportunity of observing, how much an orderly disposition of things tends to the ease and success of our inquiries, by leaving us to canvass the parts separately, and thereby rise to a gradual conception of the whole, without entangling ourselves with too many considerations at once, in any single step of the investigation. For it will indeed be found, that a dexterity and address, in the use of this last advantage, serves to facilitate and promote our discoveries, almost beyond imagination or belief.

SECTION X.

The Method of classing our Perceptions in Arithmetic.

We have already explained the manner of reducing numbers into classes, and of distinguishing these classes by their several names. And now we are farther to observe, that the present method of notation is so contrived, as exactly to fall in with this form of numbering. For as in the names of numbers, we rise from *units* to *tens*, from *tens* to *hundreds*, from *hundreds* to *thousands*, *&c.* so likewise in their notation, the same figures, in different places, signify these several combinations. Thus 2 in the first place on the right hand, denotes two *units*, in the second place it expresses so many *tens*, in the third *hundreds*, in the fourth *thousands*. By this means it happens, that when a number is written down in figures, as every figure in it expresses some distinct combination, and all combinations together make up the total sum; so may the several figures be considered as the constituent parts of the number. Thus the number 2436, is evidently, by the very notation, distinguished into four parts, marked by the four figures that serve to express it. For the first denotes *two thousand*, the second *four hundred*, the third *thirty* or *three tens*, and the fourth *six*. These several parts, though they here appear in a conjoined form, may yet be also expressed saparately thus, 2000, 400, 30, and 6, and the amount is exactly the same.

SECTION XI.

The Helps thence derived towards an easy Addition of Numbers.

This then being the case, if it is required to find a number equal to the sum of two others given; our business is, to examine separately these given numbers, and if they appear too large and bulky to be dealt with by a single effort of thought, then, since the very notation distinguishes them into different parts, we must content ourselves with considering the parts asunder, and finding their sums one after another. For since the whole is equal to all its parts, if, we find the sums of the several parts of which any two numbers consist, we certainly find the total sum of the two numbers. And therefore, these different sums, united and put together, according to the established rules of notation will be the very number we are in quest of. Let it be proposed, for instance, to find a number equal to the sum of these two: 2436, and 4552. As the finding of this by a single effort of thought would be too violent an exercise for the mind, I consider the figures, representing these numbers, as the parts of which they consist, and therefore set myself to discover their sums one after another. Thus 2, the first figure on the right hand of one, added to 6, the first figure on the right of the other, makes 8, which is therefore the sum of these two parts. Again, the sum of 5 and 3, the two figures or parts in the second place, is likewise 8. But now as figures in the second place, denote not simple *units*, but tens; hence it is plain, that 5 and 3 here, signify five *tens* and three *tens*, or 50 and 30, whose sum therefore must be eight *tens* or 80. And here again, I call to mind, that having already obtained one figure of the sum, if I place that now found immediately after it, it will thereby stand also in the second place, and so really express, as it ought to do, eight *tens* or 80. And thus it is happily contrived, that though in the addition of the *tens*, I consider the figures composing them as denoting only simple *units*, which makes the operation easier and less perplexed, yet by the place their sum obtains in the number found it expresses the real amount of the parts added, taken in their full and complete values. The same thing happens in summing the *hundreds* and *thousands*; that is, though the figures expressing these combinations, are added together as simple units: yet their sums, standing in the third and fourth places of the number found, thereby really denote the hundreds and thousands, and so represent the true value of the parts added.

SECTION XII.

Because in the several Steps by which it is carried on, the Mind is put to little or no Fatigue.

Hence then we have a manifest proof of the great advantages derived from an artful method of classing our perceptions. For as the numbers themselves are by this means distinguished into different parts which brings them more readily within the compass of the understanding; so by taking these parts separately, the operations about numbers are rendered very easy and simple. And indeed it is particularly worthy our notice, and though in adding two very large numbers together, the whole process is of sufficient length; yet the several steps by which it is conducted, are managed with incredible dispatch, and scarce any fatigue to the mind. This is apparent in the example given above, where we see, that in every advance from one part to another, nothing more is required than to add together the two figures in the like places of the numbers to be summed. But what is yet more wonderful, though in the progress of a long operation, the figures rise in their value as we advance, and grow to signify *thousands*, *millions*, *billions*, &c. yet so happily are they contrived for expressing the different parts of numbers, that in every step of the procedure we consider them as denoting only simple units, all other deficiencies being made up, by the places their sums obtain in the total amount. And thus it is so ordered in this admirable form of notation, that however large the numbers are that come under examination, they are nevertheless managed with the same ease as the most simple and obvious collections; because in the several operations about them, the mind is neither tied down to the view of too many parts at once, nor entangled with any considerations regarding the bulk and composition of those parts.

SECTION XIII.

This farther illustrated by an Example in Multiplication.

And if these advantages are so very manifest in the first and simplest rules of arithmetic, much more do they discover themselves in those that are intricate and complex. Let a man endeavour in his thoughts to find the product of two numbers, each consisting of twenty or thirty places, and that without considering the parts separately; I believe he will soon be sensible, that it is a discovery far beyond the limits of the human mind. But now in the progressive method above explained, nothing is more simple and easy. For if we take the first figure on the right hand of the one number, and by it multiply every figure of the other separately; these several products, connected according to the established laws of notation, must truly represent the total product of this other, by that part of the multiplying number. Let us suppose, for instance, the figure in the unit's place of the *multiplier*, to be 2, and the three last places of the *multiplicand* to be 432. Then, 2 multiplying 2 produces 4, which therefore is the first part of the product. Again, 2 multiplying 3 produces 6. But now 3 standing in the second place of the multiplicand, denotes its real value three *tens*, or 30, which therefore taken twice, amount to six *tens*, or 60. And accordingly the figure 6, coming after 4 already found, is thereby thrown into the second place of the product, and so truly expresses 60, its full and adequate value. The same thing happens in multiplying 4, which standing in the place of *hundreds*, its product by 2 is 800. But this very sum the figure 8, produced from 2 and 4, really denotes in the total product. Because coming after 64, the two parts already found, it is thereby determined to the third place, where it of course expresses so many *hundreds*. This process, it is evident may be continued to any length we please; and it is remarkable, that in like manner as in addition, though the value of the figures in the multiplicand continually rises upon us, yet we all along proceed with them as simple units; because the places of the several products in the total amount, represent the just result of multiplying the figures together, according to their true and adequate value.

SECTION XIV.

Of the Disposition of the several Products in order to Addition.

Having thus obtained the product by the first figure of the multiplier, we next take that in the second place, and proceed with it in the same manner. This second operation gives us the effect of that figure, considered as a simple digit. But as it stood in the second place, and therefore really denoted so many *tens*, hence it is plain, that the product now gained must be yet multiplied by *ten*, in order to express the true product sought. This is accordingly done in the operation, by placing the first figure of this second product under the second figure of the first product. For this, when they come to be added together, has the same effect as annexing a cypher, or multiplying by *ten*, as every one knows who is in the least acquainted with the rules of arithmetic. In like manner, when we multiply by the figure in the third place, as this new product is placed still one figure backwards, we do in effect annex two cyphers to it, or multiply it by a hundred. And this we ought certainly to do; because having considered the multiplying figure as denoting only simple units, when it really expressed so many hundreds, the first operation gives no more than the hundredth part of the true product. The case is the same in multiplying by the fourth or fifth figures, because, the products still running backwards, we thereby in effect annex as many cyphers to them as bring them up severally to their respective adequate value. By this means it happens, that though the figures of the multiplier in every advance, denote still higher and higher combinations, yet we all along proceed with them as simple digits; the disposition of the several products in order to addition making up for all the deficiencies that arise from this way of considering them. When in this method of procedure, we have obtained the product of the multiplicand into all the different parts of the multiplier, by adding these products together, we obtain also the total product of the two numbers. For since the whole is equal to all its parts, nothing is more evident, than that the product of any one number into another, must be equal to its product into all the parts of that other: and therefore the several partial products united into one sum, cannot but truly represent the real product sought.

SECTION XV.

Arithmetical Operations, by being carried on in a Progressive Method, rendered easy and intelligible.

Thus, we see, that in questions of multiplication, though the whole process is sometimes sufficiently long and tedious, yet the several steps by which it is carried on are all very level to the powers of the understanding. For from the account given above it appears that nothing more is required in any of them than barely to multiply one digit by another. But now this easy rule of operation is wholly derived from the before mentioned address in classing our perceptions. For to this it is owing, that the numbers under consideration are distinguished into parts, and that the several parts are also clearly represented to the mind in the very form of notation: Now as these parts have an invariable relation one to another, and advance in their value by an uniform law of progression; the understanding by means of such a link can easily hold them together, and carry its views from stage to stage without perplexity or confusion. Hence it happens, that however large and mighty the numbers are, so far as to exceed the immediate grasp of the mind; yet by running gradually through the several combinations of which they are made up, we at length comprehend them in their full extent. And because it would be impossible for the understanding to multiply very large numbers one into another, by a simple effort of thought; therefore here also it considers the parts separately, and taking them in an orderly series, advances by a variety of successive steps. It is true indeed, in the progress of the operation, the several figures rise in their value: but this consideration enters not the work itself. For there, as we have already seen, though the characters are taken as denoting only simple units, yet the order and disposition of the partial products, exhibits each according to its real amount. Hence in every step, we have only to multiply one digit by another, which as it is attended with scarce any difficulty, the whole process is carried on with wondrous dispatch. And thus by a series of easy operations, we at length rise to discoveries, which, in any other method of procedure, would have been found altogether beyond the reach of the mind.

SECTION XVI.

The Art of Classing our perceptions the great Mean and Instrument of Invention.

Since therefore by a due and orderly disposition of our ideas, we can bring the most wide and extended objects upon a level with the powers of the understanding: and since by this also we abridge the fatigue and labour of the mind, and enable it to carry on its researches in a progressive method, without which contrivance, almost all the more remote and distant truths of the sciences must have lain forever hid from our knowledge; I think we may venture to affirm, that the art of regulating and classing our perceptions is the great mean and instrument of invention. It is for this reason that I have endeavoured in so particular a manner to illustrate it from examples in numbers, because we have here not only a perfect model of the art itself, but see also in the clearest manner what helps it furnishes towards a ready comprehension of objects, and a masterly investigation of truth. Nor let any one find fault, as if we had insisted rather too long upon matters that are obvious and known to all. For I am apt to think, that though very few are strangers to the received method of notation, and the common rules of operation in arithmetic; yet it is not every one that sets himself to consider the address and sagacity that may be seen in the contrivance of them, or to unravel those principles of investigation which we have here so clearly deduced from them. And this I take to be the reason, that we sometimes meet with instances of men, who though thoroughly versed in the art of invention, with regard to some particular branches of knowledge; yet if taken out of their usual track, find themselves immediately at a stand, as if wholly bereft of genius and penetration. With such men invention is a mere habit, carried on in a manner purely mechanical, without any knowledge of the grounds and reasons upon which the several rules of investigation are founded. Hence they are unfurnished with those general observations, which may be alike usefully applied in all sciences, with only some little necessary variations, suited to the nature of the subject we are upon. And indeed I know of no surer way to arrive at a fruitful and ready invention, than by attending carefully to the procedure of our own minds, in the exercise of this distinguished faculty; because from the particular rules relating to any one branch, we are often enabled to derive such general remarks, as tend to lay open the very foundation and principles of the art itself.

SECTION XVII.

The manner of proceeding in the resolution of Algebraic Questions.

If now we turn our thoughts from *arithmetic* to *algebra*, here also we shall find, that the great invention lies, in so regulating and disposing our notices of things, that we may be enabled to proceed gradually in the search of truth. For it is the principal aim of this science, by exhibiting the several relations of things in a kind of symbolical language, so to represent them to the imagination, as that we may carry our attention from one to another, in any order we please. Hence, however numerous those relations are, yet by taking only such a number of them into consideration at once, as is suited to the reach and capacity of the understanding, we avoid perplexity and confusion in our researches, and never put our faculties too much upon the stretch, so as to loose ourselves amidst the multiplicity of our own thoughts. As therefore in *arithmetic*, we rise to a just conception of the greatest numbers as considering them made up of various progressive combinations ; so likewise in *algebra*, those manifold relations that often intervene, between known and unknown quantities, are clearly represented to the mind, by throwing them into a series of distinct equations. And as the most difficult questions relating to numbers are managed with ease ; because we can take the parts or figures separately, and proceed with them one after another ; so also the most intricate problems of algebra are in like manner readily unfolded, by examining the several equations apart, and unravelling them according to certain established rules of operation. And here it is well worth our notice, that in very complicated problems, producing a great number of different equations, it for the most part so happens, that every one of them includes a variety of unknown quantities. When therefore we come to solve them separately, as it would too much distract and entangle the mind to engage in the pursuit of so many different objects at once ; our first business is, by artfully coupling the several equations together, or by the various ways of multiplication, subtraction, addition, and substitution, to derive others from them more simple, until at length by such a gradual process we arrive at some new equation with only one unknown quantity. This done, we set ourselves to consider the equation last found, and having now to do with an object suited to the strength and capacity of the mind, easily by the established rules of the art, discover the quantity sought. In this manner we proceed with all the several unknown quantities one after another, and having by a series of distinct operations traced them separately, the question is thereby completely resolved.

SECTION XVIII.

Of those other Artifices which may be considered as Subsidiary Helps to Invention.

Hence it appears, that the business of invention, as practised in algebra, depends entirely upon the art of abridging our thoughts, reducing the number of particulars taken under consideration at once to the fewest possible, and establishing that progressive method of investigation, which we have already so fully explained from examples in arithmetic. I might easily show that the same observation holds equally in other sciences; but having already exceeded the bounds I at first prescribed to myself in this chapter, shall only add, that besides the grand instruments of knowledge already mentioned, there are innumerable other artifices, arising out of the particular nature of the subject, we are upon, and which may be considered as subsidiary helps to invention. Thus in geometry, many demonstrations of problems and theorems are wholly derived from the construction of the figure made use of, and the drawing of lines from one point to another. In like manner in algebra, the devising of proper equations from the conditions of the question proposed, and contriving neat expressions for the unknown quantities, contribute not a little to the easy solution of problems. And when we have even carried on the investigation to some single equation with only one unknown quantity; as that unknown quantity may be variously perplexed and entangled with others that are known, so as to require a multiplicity of different operations, before it can be disengaged, which often involves us in long and intricate calculations, and brings surds and irrational quantities in our way; algebraists to prevent in some measure these inconveniences, and shorten as much as possible, the process, have fallen upon several methods of substitution, which are of great service in very complicated questions. But these and such like artifices of invention, cannot be explained at length in this short essay. It is enough to have given the reader a hint of them, and put him in the way of unravelling them himself, when he comes to apply his thoughts to those particular branches of knowledge where they are severally made use of.

SECTION XIX.

Of the great advantages arising from a happy Notation or Expression of our Thoughts.

There is one thing, however, that in a particular manner deserves to be taken notice of, before we dismiss this subject; and that is, the great advantages that may redound to science, by a happy notation or expression of our thoughts. It is owing, entirely to this, and the method of denoting the several combinations of numbers by figures standing in different places, that the most complicated operations in arithmetic are managed with so much ease and dispatch. Nor is it less apparent, that the discoveries made by algebra, are wholly to be imputed to that symbolical language made use of in it. For by this means we are enabled to represent the relations of things in the form of equations, and by variously proceeding with these equations, to trace out, step by step, the several particulars we are in quest of. Add to all this, that by such a notation, the eyes and imagination are also made subservient to the discovery of truth. For the thoughts of the mind rise up and disappear, according as we set ourselves to call them into view; and therefore, without any particular method of fixing and ascertaining them as they occur, the retrieving them again when out of sight, would often be no less painful than the very first exercise of deducing them one from another. When therefore in the pursuit of truth we carry our attention forward from one part of the investigation to another, as nevertheless we have frequent occasions to look back upon the discoveries already passed through, could these be no otherwise brought into view, than by the same course of thinking in which they were first traced, so many different attentions at once must needs greatly distract the mind, and be attended with infinite trouble and fatigue. But now, the method of fixing and ascertaining our thoughts by a happy and well chosen notation, entirely removes all these obstacles. For thus, when we have occasion to run to any former discoveries, as care is taken all along to delineate them in proper characters, we need only cast our eye upon that part of the process where they stand expressed, which will lay them at once open to the mind, in their true and genuine form. By this means we can at any time take a quick and ready survey of our progress, and running over the several conclusions already gained, see more distinctly what helps they furnish towards the obtaining of those others we are still in pursuit of. Nay, further, as the amount of every step of the investigation lies fairly before us, by comparing them variously among themselves, and adjusting them one to another, we come at length to discern the result of the whole, and are enabled to form our several discoveries into an uniform and well connected system of truths, which is the great end and aim of all our enquiries.

SECTION XX.

Recapitulation.

Upon the whole then it appears, that in order to proceed successively in the exercise of invention, we must endeavour as much as possible to enlarge the capacity of the mind, by accustoming it to wide and comprehensive views of things: that we must habituate ourselves to a strong and unshaken attention, which carefully distinguishes all the circumstances that come in our way, and lets nothing material slip its notice: in fine, that we must furnish ourselves with an ample variety of intermediate ideas, and be much in the exercise of singling them out and applying them for the discovery of truth. These preparatory qualifications obtained, what depends upon art lies chiefly in the manner of combining our perceptions, and classing them together with address, so as to establish a progressive method of investigation. And here it is of great importance to contrive a proper notation or expression of our thoughts, such as may exhibit them according to their real appearance in the mind, and distinctly represent their several divisions, classes, and relations. This is clearly seen in the manner of computing by figures in arithmetic, but more particularly in that symbolical language, which hath been hitherto so successfully applied in the unravelling of algebraical problems. Thus furnished we may at any time set about the investigation of truth; and if we take care to note down the several steps of the process, as the mind advances from one discovery to another, such an arrangement or disposition of our thoughts constitutes what is called the *method of invention*. For thus it is plain that we follow the natural procedure of the understanding, and make the truths we have unravelled to succeed one another, according to the order in which they present themselves to the mind, while employed in tracing and finding them out. And here again it well deserves our notice, that as by this means the whole investigation lies distinctly before us; so by comparing the several steps of it among themselves, and observing the relation they bear one to another, we are enabled to form our discoveries into a regular system of knowledge, where the truths advanced are duly linked together, and deduced in an orderly series from first principles. This other manner of combining our thoughts, is distinguished by the name of the *method of science*, which therefore now offers itself to be explained, and is accordingly the subject of the ensuing chapter.

CHAP. II.

OF THE METHOD OF SCIENCE.

SECTION I.

Knowledge as derived from the Contemplation of our Ideas, of a necessary and unchangeable Nature.

In order to give the juster idea of the rules peculiar to this species of method, and establish them upon their proper foundation, it will be necessary to begin with settling the meaning of the word *science*, and showing to what parts of human knowledge that term may be most fitly applied. We have already observed in the first chapter of the second book, that there are three several ways of coming at the knowledge of truth. . First, by contemplating the ideas in our own minds Secondly, by the information of the senses. Thirdly, by the testimony of others. When we set ourselves to consider the ideas in our own minds, we variously compare them together, in order to judge of their agreement or disagreement. Now as all the truths deduced in this way, flow from certain connexions and relations, discerned between the ideas themselves; and as when the same ideas are brought into comparison, the same relations must ever and invariably subsist between them; hence it is plain, that the knowledge acquired by the contemplation of our ideas, is of a necessary and unchangeable nature. But farther, as the relations between our ideas, are not only supposed to be real in themselves, but also to be seen and discerned by the mind; and as when we clearly perceive a connexion or repugnance between any two ideas, we cannot avoid judging them to agree or disagree accordingly; it evidently follows, that our knowledge of this kind is attended with absolute certainty and conviction, insomuch, that it is impossible for us to withhold our assent, or entertain any doubt as to the reality of truths so offered to the understanding. The relation of equality between the whole and all its parts is apparent to every one who has formed to himself a distinct notion of what the words *whole* and *part* stand for. No man, therefore, who has these two ideas in his mind, can possibly doubt of the truth of this proposition, *that the whole is equal to all its parts*. For this would only be endeavouring to persuade himself, that that was not, which he plainly and unavoidably perceives to be. So that in all cases, where we discern a relation between any of our ideas, whether immediately by comparing the one with another, or by means of intermediate ideas, that lay it open distinctly to the understanding; the knowledge thence arising is certain and infallible. I say infallible; because we not only perceive and own the truth of propositions so offered to the mind, but having at the same time a clear view of the ground on which our assent rests, are entirely satisfied within ourselves, that we cannot possibly be deceived in this perception.

SECTION II.

As flowing from the Information of the Senses, begets undoubted Assurance, but excludes not all possibility of being deceived;

This second way of coming at knowledge, is by the means of the senses. From them we receive information of the existence of objects without us, of the union and conjunction of different qualities in the same subject, and of the operations of bodies one upon another. Thus our eyes tell us, that there is in the universe such a body as we call the sun, our sight and touch, that light and heat, or at least the power of exciting those perceptions in us, co-exists in that body; and lastly, by the same sight we also learn, that fire has the power of dissolving metals, or of reducing wood to charcoal and ashes. But now with regard to this kind of knowledge we are to observe, that though when the organs of the body are rightly disposed, and operate in a natural way, we never doubt the testimony of our senses, but from most of the schemes of life upon their information: yet are not the truths of this class attended with that absolute and infallible assurance, which belongs to those derived from the contemplation of our own ideas. We find that the senses frequently represent objects as really existing, which have yet no being but in our own imaginations; as in dreams, frenzies, and the deliriums of a fever. A disorder too in the organs, makes us often ascribe qualities to bodies, entirely different from those they appear to possess at other times. Thus a man in the jaundice shall fancy every object presented to him yellow: and in bodily distempers, where the taste is greatly vitiated, what naturally produces the idea of sweetness, is sometimes attended with a quite contrary sensation. It is true, these irregularities neither ought, nor indeed do they, with considerate men, in any ways tend to discredit the testimony of experience. He that, awake, and in his senses, and satisfied that his organs operated duly, should take it into his head to doubt whether fire would burn, or arsenic poison him, and therefore rashly venture upon these objects, would soon be convinced of his error, in a way not much to his liking. As nevertheless the senses do sometimes impose upon us, there is no absolute and infallible security that they may not at others; therefore the assurance they produce, though reasonable, satisfying, and sufficiently well founded to determine us in the several actions and occurrences of life, is yet of such a nature, as not necessarily to exclude all possibility of being deceived.—Hence some men go so far as to maintain, that we ought to distrust our senses altogether; nay, whole sects among the ancients, because of this bare possibility, which really extends no farther than to matters of *experience* and *testimony*, yet established it as a principle, that we ought to doubt of every thing. Nor are there wanting philosophers among the moderns, who upon the same grounds, deny the existence of bodies, and ascribe the perceptions excited in us, not to the action of external matter, but to certain established laws in nature, which operate upon us in such a manner as to produce all those several effects that seem to flow from the real presence of objects variously affecting our perception. It is not my design here to enter into a particular discussion of these matters: all I aim at, is to show, that the testimony of the senses, though sufficient to convince sober reasonable men, yet does not so unavoidably extort our assent, as to leave no room for suspicion or distrust.

SECTION III.

As founded upon Testimony, is of a still more certain Nature, though in many Cases embraced without wavering or distrust.

The third and last way of coming at truth is by the report and testimony of others. This regards chiefly past facts and transactions, which having no longer any existence, cannot be brought within the present sphere of our observation. For as these could never have fallen under our cognizance, but by the relations of such as had sufficient opportunities of being informed; it is hence apparent, that all our knowledge of this kind is wholly founded upon the conveyance of testimony. But now, although this in many cases is a sufficient ground of assent, so as to produce a ready belief in the mind, yet is it liable to still greater objections than even the reports of experience. Our senses, it is true, on some occasions deceive us, and therefore they may possibly on others. But this bare possibility creates little or no distrust; because there are fixed rules of judging, when they operate according to nature, and when they are prevented or given up to caprice. It is otherwise in matters of mere human testimony. For there, besides the supposition that the persons themselves may have been deceived, there is a farther possibility, that they may have conspired to impose upon others by a false relation. This consideration has the greater weight, as we frequently meet with such instances of disingenuity among men, and know it to be their interest in some particular cases, to dissemble and misrepresent the truth. It would, nevertheless, be the height of folly, to reject all human testimony without distinction because of this bare possibility. Who can doubt whether there ever were in the world such conquerors as *Alexander* and *Julius Cæsar*? There is no absolute contradiction, indeed, in supposing, that historians may have conspired to deceive us. But such an universal concurrence to a falsehood, without one contradicting voice, is so extremely improbable, and so very unlike what usually happens in the world, that a wise man could as soon persuade himself to believe the grossest absurdity, as to admit of a supposition so remote from every appearance of truth. Hence the facts of history, when well attested, are readily embraced by the mind; and though the evidence attending them be not such as produces a necessary and infallible assurance, it is yet abundantly sufficient to justify our belief, and leave those without excuse, who, upon the bare ground of possibility, are for rejecting entirely the conveyance of testimony.

SECTION IV.

Science belongs entirely to that Branch of Knowledge which is derived from the Contemplation of our Ideas.

Upon the whole, then, it appears, that absolute certainty, such as is attended with unavoidable assent, and excludes all possibility of being deceived, is to be found only in the contemplation of our own ideas. In matters of experience and testimony, men, we see, may frame pretences for suspicion and distrust: but in that part of knowledge which regards the relations of our ideas, none such can have place. For as all these several relations are either immediately discerned by the mind, or traced by means of immediate ideas, where self-evidence is supposed to accompany every step of the procedure, it is absolutely impossible for a man to persuade himself that that is not, which he plainly and necessarily perceives, to be. Now it is to knowledge, attended with this last kind of evidence alone, that in strictness and propriety of speech we attribute the name of *science.* For *science* implies perception and discernment, what we ourselves see and cannot avoid seeing; and therefore has place only in matters of absolute certainty, where the truths advanced are either intuitive propositions, or deduced from them in a way of strict demonstration. And as this kind of certainty is no where to be found, but in investigating the relations of our ideas; hence it is plain, that *science,* properly speaking, regards wholly the first branch of human knowledge; that which we have said is derived from a contemplation of the ideas in our own minds.

SECTION V.

Our Knowledge of the real Existence of Objects not Intuitive.

But here I expect it will be asked, if *science* and *demonstration* belong only to the consideration of our own ideas, what kind of knowledge it is, that we have relating to bodies, their powers, properties, and operations one upon another? To this I answer, that we have already distinguished it by the name of *natural* or *experimental.* But that we may see more distinctly wherein the difference between *scientifical* and *natural* knowledge lies, it may not be improper to add the following observations. When we cast our eyes towards the sun, we immediately conclude, that there exists an object without us, corresponding to the idea in our minds. We are, however, to take notice, that this conclusion does not arise from any necessary and unavoidable connexion discerned, between the appearance of the idea in the mind, and the real existence of the object without us. We all know by experience, that ideas may be excited, and that too by a seeming operation of objects upon our senses, when there are in fact no such objects existing; as in dreams, and the deliriums of a fever. Upon what then is the before-mentioned conclusion properly grounded! Why, evidently upon this: that as we are satisfied our organs operate duly, and know that every effect must have a cause, nothing is more natural than to suppose, that where an idea is excited in the mind, some object exists corresponding to the idea which is the cause of that appearance. But as this conclusion, by what we have seen, is not necessary and unavoidable, hence there is no *intuition* in the case, but merely a probable conjecture, or reasonable presumption, grounded upon an intuitive truth.

SECTION VI.

Absolute Certainty in natural Knowledge confined to what falls under our immediate Notice.

Again, when a piece of gold is dissolved in *aqua regia*, we see indeed and own the effect produced, but cannot be said, in strictness and propriety of speech, to have any perception or discernment of it. The reason is, because being unacquainted with the intimate nature both of *aqua regia* and gold, we cannot, from the ideas of them in our minds, deduce why the one operates upon the other in that particular manner. Hence it is, that our knowledge of the facts and operations of nature extends not with certainty beyond the present instance, or what falls under our immediate notice; so that in all our researches relating to them we must proceed in the way of trial and experiment, there being here no general or universal truths, whereon to found *scientifical* deductions. Because the solution of gold in *aqua regia* holds in one experiment, we cannot thence infallibly conclude that it will hold in another. For not knowing upon what it is, in either of these bodies, that the effect here mentioned depends, we have no absolute certainty in any new experiment we propose to make, that the objects to be applied one to another have that precise texture and constitution from which this solution results. Chemists know by experience, that bodies which go by the same name, and have the same outward appearance, are not always, however exactly alike in their powers and operations. In vain do they often search for those properties in one piece of *antimony*, which on former occasions, they may have found in another; and by this means, to their no small mortification, find themselves frequently disappointed, in very costly and promising experiments. Nor have we any express and positive assurance, that the very bodies with which we have formerly made experiments, continue so exactly the same, as to afford the like appearances in any succeeding trial. A thousand changes happen every moment in the natural world, without our having the least knowledge or perception of them. An alteration in our atmosphere, the approach or recess of the sun, his declination towards the north or south, not only vary the outward face of things, but occasion many changes in the human constitution itself, which we yet perceive not when they happen; nor should ever be sensible of, but by the effects and consequences resulting from them. And whether alterations analagous to these may not sometimes be produced in the frame and texture of many bodies that surround us, is what we cannot with certainty determine. Hence, from an experiment's succeeding in one instance, we cannot infallibly argue, that it will succeed in another, even with the same body. The thing may indeed be probable, and that in the highest degree; but as there is still a possibility that some change may have happened to the body, unknown to us, there can be no absolute certainty in the case.

SECTION VII.

What kind of Knowledge of Body would deserve the name of Science.

Had we such an intimate acquaintance with the structure both of *aqua regia* and gold, as to be able thence to discern why the one so operates upon the other as to occasion its dissolution; insomuch that from the ideas of them in our own minds, we could clearly reduce, that bodies of such a make applied one to another, must necessarily produce the effect here mentioned; our knowledge would then be *scientifical*, and stand upon the foundation either of *intuition* or *demonstration*, according as the perception was immediate, or attained by means of intervening ideas. In this case, therefore, having two standard ideas in our minds, whose relations we perfectly well know; wherever we found objects conformable to these ideas, we could then pronounce with certainty, that the application of them one to another would be attended with the above effect: because, whatever is true in idea, is unavoidably so also in reality of things, where things exist answerable to these ideas. If it be true in idea, that a parallelogram is the double of a triangle, standing upon the same base, and between the same parallels; the same will be true of every real triangle and parallelogram, that exist with the conditions here mentioned. We are likewise to observe, that the changes to which bodies are daily liable, could produce no confusion or perplexity in natural knowledge, did it stand upon the foundation here mentioned. For in such a case the powers and properties of objects being deduced from the ideas of them in our own minds, would no otherwise be applied to things really existing, than as these things are found perfectly conformable to our ideas. When, therefore, an alteration happened in any body, as it would by this means differ from that standard idea whence its former properties were seen to flow, we must of course be sensible, that some suitable change would follow in the properties themselves, and that its powers and operations, in regard of other bodies, would not be in all respects the same.

SECTION VIII.

Experience the only Foundation of Natural Knowledge.

But what is still more remarkable, we should, upon this supposition, be able to determine the mutual action and influence of bodies, without having recourse to trial or experiment. Had we, for instance, a perfect knowledge of the intimate nature and composition of an animal body, and of that particular poison that is infused into it by the bite of a viper, so as clearly and distinctly to discern how they are adapted one to another; we might thence scientifically deduce, without the help of experiments, that the bite of a viper would so unhinge the human fabric, and produce such ferments and combustions in it, as must necessarily be followed by a total extinction of all the vital functions, and leave that admirable machine a mere lifeless lump. But as such perfect and adequate ideas of objects, and their mutual habitudes one to another, are plainly beyond the reach of our present faculties; it were vain for us to think of improving natural knowledge by abstract reasoning or scientifical deductions. Experience is here the true and proper foundation of our judgments, nor can we by any other means arrive at a discovery of the several powers and properties of bodies. How long might a man contemplate the nature of hemlock, examine the structure of its parts in a microscope, and torture and analyse it by all the processes of chemistry, before he could pronounce with certainty the effect it will have upon a human body? One single experiment lays that open in an instant, which all the wit and invention of men would never of themselves have been able to trace. The same holds in all the other parts of natural philosophy. Our discoveries relating to electricity, the powers and properties of the loadstone, the force of gun-powder, &c. were not gained by reasoning, or the consideration of our abstract ideas, but by means of experiments made with the bodies themselves. Hence it happened, that while the philosophy of *Aristotle* prevailed in the schools, which dealt much in metaphysical notions, occult qualities, sympathies, antipathies, and such like words without meaning; the knowledge of nature was at a stand: because men pretended to argue abstractedly about the things of which they had no perfect and adequate ideas, whereon to ground such a method of reasoning. But now in the present age, that we have returned to the way of trial and experiment, which is indeed the only true foundation of natural philosophy; great advances have already been made, and the prospect of still greater lies before us.

SECTION IX.

Difference between Scientifical and Natural Knowledge.

And thus at length we may sufficiently understand wherein the proper difference lies between scientifical and natural knowledge. In matters of science we argue from the ideas in our own minds, and the connexions and relations they have one to another. And as when these relations are set clearly and plainly before us, we cannot avoid perceiving and owning them, hence all the truths of this class produce absolute certainty in the mind, and are attended with a necessary and unavoidable assent. It is otherwise in the case of natural knowledge. Intuition and inward perception have here no place. We discern not the powers and properties of those objects that surround us, by any view and comparison of the ideas of them one with another, but merely by experience, and the impressions they make on the senses. But now the reports of sense happening in some instances to deceive us, we have no infallible assurance that they may not in others; which weakens not a little the evidence attending this kind of knowledge, and leaves room for suspicion and distrust. Nay, what is yet more considerable, as we have no perfect and adequate ideas of bodies, representing their inward constitution, or laying open the foundation upon which their qualities depend, we can form no universal propositions about them, applicable with certainty in all particular instances. Fire, we say, dissolves metals. This though expressed indefinitely, is, however, only a particular truth, nor can be extended with absolute assurance, beyond the several trials made. The reason is, that being ignorant of the inward frame and composition both of fire and metals; when objects are offered to us under that name, we have therefore no positive certainty that they are of the very make and texture, requisite to the success of the experiment. The thing may indeed be probable in the highest degree; but for want of standard and settled ideas, we can never arrive at a clear and absolute perception in the case.

SECTION X.

The Manner of Reasoning in Natural Knowledge.

As nevertheless, it is certain that many general conclusions in natural philosophy are embraced without doubt or hesitation; nay, that we form most of the schemes and pursuits of life upon that foundation; it will naturally be asked here, how come we by this assurance? I answer, not scientifically, and in the way of strict demonstration, but by analogy, and an induction of experiments. We distinguish fire, for instance, by such of its qualities as lie more immediately open to the notice of the senses; among which light and heat are the most considerable. Examining still farther into its nature, we find it likewise possessed of the power of dissolving metals. But this new property not having any necessary connexion that we can trace, with those other qualities by which fire is distinguished, we cannot therefore argue with certainty, that wherever light and heat, &c. are, the power of dissolving metals co-exists with them. 'Tis not till after we have tried the thing in a variety of experiments, and found it always to hold, that we begin to presume there may be really some such connexion, though our views are too short and imperfect to discover it. Hence we are led to frame a general conclusion, arguing from what has already happened, to what will happen again in the like cases, insomuch that where we meet with all the other properties of fire in any body, we have not the least doubt, but that upon trial, the power above mentioned will be found to belong to it also. This is called reasoning by *analogy;* and it is, as we see, founded entirely upon induction, and experiments made with particular objects; the more precise and accurate our ideas of these objects are, and the greater the variety of experiments upon which we build our reasoning, the more certain and undoubted will the conclusions be. 'Tis in this manner we arrive at the general truths of natural knowledge: as that the bite of a certain animal is mortal; that a needle touched by a load-stone points to the north; that gravity belongs universally to all bodies; and innumerable others, which, though not capable of strict demonstration, are nevertheless as readily embraced upon the foundation of analogy, as the most obvious and intuitive judgments; nay, and become fixed and steady principles of action, in all the aims and pursuits of life.

SECTION XI.

How even Scientifical Reasoning may be introduced into it.

And here again it is particularly remarkable, that having ascertained the general properties of things by analogy, if we proceed next to establish these as *postulata* in philosophy, we can, upon this foundation, build strict and mathematical demonstrations, and thereby introduce *scientifical* reasoning into natural knowledge. In this manner, Sir *Isaac Newton*, having determined the laws of gravity by a variety of experiments, and laying it down as a principle, that it operates according to those laws through the whole system of nature, has thence, in a way of strict demonstration, deduced the whole theory of the heavenly motions. For granting once this *postulatum*, that gravity belongs universally to all bodies, and that it acts according to their solid content, decreasing with the distance in a given ratio; what Sir Isaac has determined in regard to the planetary motions, follows from the bare consideration of our own ideas; that is, necessarily and *scientifically*. Thus likewise in *optics*, if we lay it down as a principle, that light is propagated on all sides in right lines, and that the rays of it are reflected and refracted according to certain fixed and invariable laws, all which is known to be true by experience; we can upon this foundation establish mathematically the theory of vision. The same happens in *mechanics*, *hydrostatics*, *pneumatics*, &c. where from *postulata* ascertained by experience, the whole theory relating to these branches of knowledge follows in a way of strict demonstration. And this I take to be the reason why many parts of natural philosophy are honoured with the name of *sciences*. Not that they are ultimately founded upon intuition ; but that the several principles peculiar to them being assumed upon the foundation of experience, the theory deduced from these principles established by *scientifical* reasoning.

SECTION XII.

Yet still Experience is the ultimate Ground of our Assent.

Could we indeed discern any necessary connexion between gravity and the known essential qualities of matter, insomuch that it was inseparable from the very idea of it ; the whole theory of the planetary motions would then be strictly and properly *scientifical*. For seeing, from the notion of gravity, we can demonstratively determine the laws that bodies will observe in their revolutions, in any known circumstances ; if the circumstances relating to any system of bodies can be traced, and gravity is supposed essential to them, we can then, from the bare consideration of our own ideas, deduce all their motions and phenomena. Now this is precisely what Sir Isaac has done in regard to our planetary system. He has determined the circumstances of the bodies that compose it, in respect of situation, distance, magnitude, &c. all which being supposed, if they are essentially actuated by gravity, their several revolutions and appearances must be equally essential. But as the principle of gravitation cannot be accounted for by the known qualties of matter, neither can this theory be immediately deduced from the idea of body ; and therefore, though our reasoning in this part of philosophy be truly scientifical, yet as the principle upon which that reasoning is grounded, is derived from experince, the theory itself must needs ultimately rest upon the same foundation. And thus even the doctrine of the planetary motions, though seemingly established by mathematical reasoning, falls yet, in strictness and propriety of speech, under the head of natural knowledge. For in this precisely consists the difference between *science*, and what we call the philosophy of *nature*; that the one is grounded ultimately on *intuition*, the other on *experience*. As the observation here made holds alike in all the other branches of natural philosophy, into which *scientifical* reasoning has been introduced; it is hence apparent, that they are not *sciences*, in the strict and proper sense of the word, but only by a certain latitude of expression common enough in all languages. What we have therefore said above, relating to the impossibility of improving natural knowledge, by scientifical deductions, is not contradicted by any thing advanced in this section. We there meant deductions grounded ultimately on intuition, and derived from a consideration of the abstract ideas of objects in our own minds; not such as flow from *postulata*, assumed upon the foundation of experience. For these last, as we have already observed, are not truly and properly scientifical, but have obtained that name merely on account of the way of reasoning in which they are collected from the said *postulata*.

SECTION XIII.

The Manner of Reasoning in Historical Knowledge.

If then absolute and infallible certainty is not to be obtained in natural knowledge, much less can we expect it in historical. For here testimony is the only ground of assent, and therefore the possibility of our being deceived, is still greater than in the case of experience. Not only he who reports the fact may himself have formed a wrong judgment; but could we even get over this scruple there is still room to suspect, that he may aim at imposing upon us by a false narration. In this case, therefore, it is plain, there can be no intuition or inward perception of truth, no strict and absolute demonstration, and consequently no *science*. There is, however, a way of reasoning even here, that begets an entire acquiescence, and leads us to embrace without wavering, the facts and reports of history. If, for instance, it appears, that the historian was a man of veracity; if he was a competent judge of what he relates; if he had sufficient opportunities of being informed; if the book that bears his name was really written by him; if it had been handed down to us uncorrupted; in fine, if what he relates is probable in itself, falls in naturally with the other events of that age, and is attested by contemporary writers; by these and such like arguments, founded partly on criticism, partly on probable conjecture, we judge of past transactions; and though they are not capable of *scientifical* proof, yet in many cases we arrive at an undoubted assurance of them. For as it is absurd to demand mathematical demonstration in matters of fact, because they admit not of that kind of evidence: it is no less so to doubt of their reality when they are proved by the best arguments their nature and quality will bear.

SECTION XIV.

Scepticisms necessarily excluded from Matters of Science.

And thus we see, in the several divisions of human knowledge, both what is the ground of judging and the manner of reasoning, peculiar to each. In *scientifical* knowledge, which regards wholly the abstract ideas of the mind, and those relations and connexions they have one with another; our judgments are grounded on *intuition*, and the manner of reasoning is by *demonstration*. In *natural* knowledge, respecting objects that exist without us, their powers, properties, and mutual operations; we judge on the foundation of *experience*, and reason by *induction* and *analogy*. Lastly, in *historical knowledge*, which is chiefly conversant about past facts and transactions, *testimony* is the ground of judgment, and the way of reasoning is by *criticism* and *probable conjecture*. And now I think we are able effectually to overthrow that absurd kind of *scepticism* maintained by some of the ancients which brings all propositions upon a level, and represents them as equally uncertain. What gave the first rise to this doctrine was, caprice of certain philosophers, who observing that the reports of sense and testimony were in some instances deceitful, took thence occasion to suppose that they might be so likewise in others, and thereupon established it as a principle, that we ought to doubt of every thing. But even with respect to this doubting, we are to observe, that it can in fact extend no further than to matters of *experience* and *testimony*, being totally and necessarily excluded from *scientifical* knowledge. When ideas make their appearance in the understanding, it is impossible for us to doubt of their being there. And when the relation of any of our ideas are clearly and distinctly discerned by the mind, either immediately, which is *intuition*, or by means of intervening ideas, which is *demonstration*: it would be in vain for us to endeavour to persuade ourselves that that is not which we plainly and unavoidably perceive to be. In this case, therefore, we cannot withhold our assent; truth forces its way over all opposition, and breaks in with so much light upon the mind, as to beget absolute and infallible certainty.

SECTION XV.

And to be admitted with caution in Matters of Experience and Testimony.

Indeed, in natural and historical knowledge *scepticism* may have place; because, as we have said, there is a possibility of our being deceived. But then it is to be observed, that a bare possibility is a very weak ground whereon to bottom any philosophical tenet. It is possible, that *Great Britain* may be swallowed up by the sea before tomorrow; but I believe no man is on this account inclined to think it will be so. It is possible the whole human race may be extinguished the next instant; yet this possibility creates no apprehension that the thing itself will really happen. In a word, we ought to judge of things by the proofs brought to support them, not by bare abstract possibilities; and when we have all the evidence they are capable of, that alone is sufficient to convince, though perhaps the contrary cannot be shown to imply a contradiction. Will any wise and considerate man doubt whether there be such a place as *Africa*, because we cannot prove, by any necessary argument, that it is absolutely impossible all the relations concerning it should be false? Strict and rigorous demonstrations belong not to history, or the philosophy of nature. The way of reasoning, in these branches of knowledge, is by arguments drawn from experience and testimony. And when the truth of any proposition is in this manner sufficiently ascertained, insomuch that it appears with all the evidence it is capable of, and we have as great reason to believe that it is, as we could possibly have, supposing it were, is not this upon the matter as satisfactory as demonstration? It must be owned, indeed, there is no inward perception in the case; and therefore our assent cannot be said to be necessary and unavoidable. Men may in these matters be *sceptics*, if they please; and if they are resolved upon it, it is in vain to contend with obstinacy aud perverseness. I cannot, however, but observe, that if they will really act up to their own principles, and treat all things in good earnest as uncertain, that admit not of strict scientifical proof, their conduct must be the very madness of folly. No man can demonstrate mathematically, that poison has not been conveyed into his meat or drink. And if he will be so very cautious as not to taste of either, till he has reached this degree of certainty, I know no other remedy for him, but that in great gravity and wisdom he must die for fear of death. The truth of it is, the most zealous patrons of *scepticism*, after all their pretended doubts and scruples, find it yet convenient to behave, in the several occurrences of life, as if they gave entire credit to the reports of sense and testimony. They will no more venture upon a dose of arsenic, or rush into the midst of a glowing furnace, than if they verily believed death would be the consequence. And though in this it must be owned they act discreetly, yet have we hence at the same time a very convincing argument of the absurdity of those notions they affect to entertain. In reality, can any thing be more ridiculous, than to give into a scheme of thinking, which we find ourselves necessitated to contradict in almost every occurrence of life? Opinions are not to be taken up out of caprice and fancy, but to serve as principles of action and standing rules of behaviour. When they answer not this main purpose, they are unavailing and fruitless, and an obstinate adherence to them, in spite of repeated admonitions of experience, justly deserves to be branded for folly. We shall not, therefore, attempt to multiply arguments in a matter so obvious, it sufficiently answering our present purpose to have shown, that doubting and uncertainty have no place in scientifical knowledge, and that even in matters of history, and the facts of nature, an undistinguishing scepticism would be in the highest degree absurd.

SECTION XVI.

Science applicable to the Concerns of Human Life.

But here, perhaps, it will be asked, why all this mighty noise about science, when, even according to the present account, it seems to be so very capricious and arbitrary a thing? For seeing it is wholly confined to the consideration of our ideas, and we are at liberty to frame and combine those ideas at pleasure, this indeed opens a way to castles in the air of our own building, to many chimerical and fanciful systems, which men of warm and lively imaginations love to entertain themselves with, but promises little of that knowledge which is worth a wise man's regard, and respects the great ends and purposes of life. Where is the advantage of barely contemplating our ideas, and tracing their several habitudes and relations, when it is in truth the reality of things that we are chiefly concerned to know, and those respects they bear to us and one another? To this I answer: that if indeed our ideas no way regarded things themselves, the knowledge acquired by their means would be of very little consequence to human life. But since, as we have already observed, whatever is true in idea is unavoidably so also in the reality of things, where things exist answerable to these ideas; it is apparent that by copying our ideas with care from the real objects of nature, and framing them in a conformity to those conjunctures and circumstances in which we are most likely to be concerned, a way is laid open to discoveries of the greatest importance to mankind. For in this case, our several reasonings and conclusions, holding no less of the objects themselves, than of the ideas by which they are represented, may be therefore applied with certainty to these objects, as often as they fall under our notice. Thus mathematicians having formed to themselves ideas of cones, cylinders, spheres, prisms, &c. variously compare them together, examine their several properties, and lay down rules by which to calculate their relative bulk and dimentions. But now, as bodies answering in figure to these ideas come frequently under our observation, we have by this means an opportunity of applying mathematical knowledge to the common concerns of life: and by determining precisely the quantity of extension in each body, can the better judge how far they will answer the purposes we have in view. The same thing happens in politics and morality. If we form to ourselves ideas of such communities, connexions, actions and conjunctures, as do or may subsist among mankind; all our reasonings and conclusions will then respect real life, and serve as steady maxims of behaviour in the several circumstances to which it is liable. It is not, therefore, enough that we set about the consideration of any ideas at random: we must further take care that those ideas truly regard things themselves; for although knowledge is always certain, when derived from the contemplation of our own ideas, yet it is then only useful and worthy our regard, when it respects ideas taken from the real objects of nature, and strictly related to the concerns of human life.

SECTION XVII.

The Method of Science begins with ascertaining our Ideas.

Having thus shown that there is such a thing as *science*, fixed and ascertained the bounds of it, and explained its great use and importance in the affairs of mankind; it now remains that we lay down the rules of method peculiar to this branch of knowledge, and give some account of the manner in which that certainty and conviction which are inseparable from it, may be most naturally and effectually produced. *Science*, as we have said, regards wholly the abstract ideas of the mind, and the relations they have one to another. The great secret, therefore, of attaining it lies in so managing and conducting our thoughts, as that these several relations may be laid open to the view of the understanding, and become the necessary and unavoidable objects of our perception. In order to this we must make it our first care distinctly to frame and settle the ideas about which our inquiries are to be employed. For as the relations subsisting between them can no otherwise be discerned, than by comparing them one with another—and as this comparison necessarily supposes that the ideas themselves are actually in the mind and at that very time under our immediate inspection—it plainly follows, that all science must begin with fixing and ascertaining those ideas. Now our ideas, as has been already observed in the first book, come all very naturally within the division of *simple* and *complex*. *Simple* ideas are excited by actual impressions made upon the understanding; and as they exist under one uniform appearance, without variety or composition, are in no danger of being mistaken, or confounded one with another. It is otherwise in our *complex* conceptions. For these consisting of many simple ideas joined together, great care must be taken, that we acquaint ourselves with the true number combined, and the order and manner of their connexion. By this means alone are these our most intricate notices, kept distinct and invariable, insomuch that in all our several views of them, they ever have the same appearance, and exhibit the same habitudes and respects. Here, therefore, properly speaking, the art of knowledge begins. For although we find it easy enough to bound and settle our ideas, where they consist of but few simple perceptions; yet when they grow to be very complicated, it often requires great address and management to throw them into such views as may prevent that confusion which is apt to arise from the joint consideration of a multiplicity of different objects. Hence that gradation in the composition of our ideas which we have explained at large in the last chapter of the first book. For as they are by this means formed into different orders, and these orders arise continually one out of another; the understanding, by taking them in a just succession, gradually mounts to the highest conceptions, and can, at any time, with incredible ease and expedition, bring all their parts distinctly into view. To know, therefore, the full value of this contrivance, we must attentively consider the strict connexion that obtains between the several classes of our perceptions when disposed in such a series. Every succeeding order is formed out of those combinations that constitute the rank next below it. And as in advancing from one degree to another, we are always to proportion the number of notices united, to the strength and capacity of the mind; it is apparent, that by such a procedure, the ideas will be thoroughly ascertained in every step, and however large and bulky, lie yet fairly within our grasp. This obviously accounts for that wonderful clearness of apprehension, which we often experience within ourselves, even in regard to the most complicated conceptions. For though the multitude of parts in many cases be great, I may say beyond belief, yet as they have been all previously formed into separate classes, and the classes themselves distinctly settled in the understanding; we find it easy, by such a series of steps, to rise to any idea, how complex soever, and, with a single glance of thought, to embrace it in its full extent.

SECTION XVIII.

And communicating them by Means of Definitions.

But it is not enough that we barely form ideas in our own minds; we must also contrive a way to render them stable and permanent, that when they disappear upon calling off our attention, we may know how to retrieve them again with certainty. This is best done by words and descriptions, which serve not only to subject them to their own review, but also to lay them open to the perceptions of others. And indeed, as one of the main ends of reducing knowledge into the form of a science is, the easy and advantageous communication of truth; it ought always to be our first care, when we set about unfolding our discoveries, to exhibit the several conceptions to which they relate, in a just and accurate series of definitions. For till we have distinctly transferred our ideas into the ununderstanding of those to whom we address ourselves, and taught their connexion with the appropriated sounds, all our reasonings will evidently be without effect. If men comprehend not the true import of our words, and are therefore led by them to bring wrong ideas into comparison, they can never sure see connexions and habitudes that really subsist not. But if, on the contrary, the terms we use, excite those very conceptions in others, which they denote in our own minds; then, as the several relations pointed out will lie fairly open to view, they must needs be discerned with great readiness and ease, and stamp the character of certainty upon all our deductions.

SECTION XIX.

The Names of simple Ideas constitute the original and elementary Terms of Language.

Thus we see that the *method of science* begins with unfolding our ideas, and communicating them by means of definitions. And here it is of great importance to observe, that there must be in all languages, certain original and elementary names, whence our descriptions take their first rise, and beyond which we cannot trace the meaning and signification of sounds. For since our very definitions are made up of words, if we suppose not such primitive and fundamental terms, into which they all resolve themselves, and where they at last necessarily terminate, it is evident there would be no end of explaining. Now it is peculiar to our simple ideas, that they cannot be originally excited by words, but must always make their first entrance into the understanding by the actual operation of objects upon it. When, therefore, in a series of definitions, we arrive at the names of these ideas, 'tis plain we can push our descriptions no farther, but are necessitated to suppose, that the perceptions themselves have already found admission into the mind. If they have not, definitions avail nothing; nor can they any other way be impressed upon us, than by betaking ourselves to the several objects in which the power of producing them resides. Hence it appears, that the primary articles of speech, into which the whole of language may be ultimately resolved, are no other than the names of simple ideas. These, we see, admit not definitions. It is by experience and observation, that we grow acquainted with their meaning, and furnish ourselves with the perceptions they serve to denote. For finding that those in whose society we live, make use of certain articulate sounds, to make the various impressions of objects, we too annex these sounds to the same impressions, and thus come to understand the import of their words. This way of knowledge takes place, in regard to all our simple ideas; but in many of those that are complex, as they are the mere creatures of the understanding, and exist no where out of the mind, there are, of course, no real objects without us, whence they may be originally obtained. If, therefore, they could not be communicated by descriptions, we should be left wholly without the means of transferring them into the minds of others. But happily it so falls out, that all complex conceptions whatsoever may be distinctly exhibited in definitions. For as they are no more than different combinations of simple ideas, if these, simple ideas have already got admission into the understanding, and the names serving to express them are known; it will be easy, by describing the order, number, and peculiar connexion of the notices combined, to raise in the mind of another the complex notion resulting from them.

SECTION XX.

A Knowledge of these previously supposed in handling any Subject scientifically.

Since then it is by simple ideas and their names, that we unfold all the other conceptions of the mind; it manifestly follows, that in handling any subject *scientifically*, we must always suppose those to whom we address ourselves, previously furnished by experience with these first principles and elements of knowledge. Nor is this by any means an unreasonable *postulatum*: because the simple ideas that relate to the sciences, being few in number, and coming very often in our way, it is hardly possible we should be unacquainted with them, or not have frequently heard their names in converse with others. What principally demands our care is to apply those names aright, and according to the strict use and propriety of the language in which we write. 'Tis seldom allowable to change the signification of words, especially those by which we denote simple ideas. If, however, such a liberty should at any time be found necessary, we may still make ourselves understood, by mentioning the idea under its common name, and signifying its connexion with the newly appropriated sound. Indeed, it sometimes happens, that new and unusual ideas of this kind are to be taken under consideration, which we must therefore express by terms of our own invention. In this case, as the ideas themselves cannot be laid open by definitions, we refer to the several objects whence they may be obtained; which, though it excites not the perceptions immediately, yet sufficiently answers our purpose, by putting men in a way of being furnished with them at pleasure.

SECTION XXI.

The Order and Connexion of our Definitions.

This foundation being laid, the communication of our complex conceptions by definitions becomes both easy and certain. For since the ideas themselves are formed into different orders, and these orders arise continually one out of another; nothing more is required on our part, than to observe a like method and gradation in our descriptions. As, therefore, the first order of our compound notions is formed immediately from simple ideas; so the terms appropriated to this order must be defined by the names of these ideas. And as the second and all the succeeding orders arise continually out of those combinations that constitute the classes next below them, so the definitions corresponding to these different orders gradually take in the terms by which the several inferior divisions are regularly and successively expressed. In such a series of descriptions, it is evident, at first sight, that nothing can be obscure and unintelligible. For as it begins with the names of simple ideas, whose meaning is supposed to be known—and as in every order of definitions, such terms only occur, as have been previously explained in the preceding distributions—by advancing regularly from one to another, we gradually furnish ourselves with whatever is necessary towards a distinct conception of all that is laid before us. Nor is it a small advantage attending this disposition, that the several ideas described are hereby excited in the understanding, in the very order and manner in which they are framed by a mind advancing uniformly from simple to the most complicated notions. Hence we see distinctly the various dependence of things, and being put into that very train of thinking which leads directly to science and certainty, are drawn insensibly to interest ourselves in the pursuit; insomuch, that while in fact we do no more than follow a guide and conductor, we can yet hardly forbear fancying ourselves engaged in the actual exercise of deducing one part of knowledge from another.

SECTION XXII.

Of the immediate and intuitive Relations between our Ideas.

When we have thus fixed and ascertained our ideas, and distinctly exhibited them in definitions, we then enter upon the important task of tracing their several habitudes and relations. In order to this, we set about comparing them among themselves, and viewing them in all the variety of lights, by which we can hope to arrive at a discovery of their mutual agreement or disagreement. And here it happens, that some relations forwardly offer themselves to the notice of the understanding, and become the necessary objects of perception, upon the very first application of our ideas one to another. Those are therefore, immediately owned, and constitute our *primary* and *intuitive* judgments, being attended with the highest degree of evidence, and producing absolute certainty in the mind. But in many cases, the connexion or repugnance between our ideas, even when true and real, comes not yet within our immediate view, but requires search and examination to discover it. On this occasion, we have recourse to intermediate notice, and if by means of them we can muster up a train of evident and known truths, which, disposed in a regular series of argumentation, lead at last to a conclusion expressing the relations we are in quest of, the proof thence arising is called *demonstration.* Now as the conviction attending *demonstration*, is no less necessary and unavoidable than that which proceeds from *intuition;* it evidently follows, that whether the relations between our ideas are immediately discerned by the mind, or whether they are traced by means of intervening perceptions, in either case we arrive at *science* and certainty. This, however, is particularly to be observed, that the more remote and distant respects, being deduced from such as are obvious and self-evident, the propositions expressing these last demand our first notice, and ought to be previously established, before we enter upon higher investigations. When, therefore, in the *method of science*, we have finished the business of definitions: it must be our next care distinctly to unfold in propositions, those immediate and intuitive relations, which are necessarily seen and owned by the mind, upon the very first comparing of our ideas one with another. These propositions have obtained the name of *first principles*, because occurring *first* in the order of knowledge, and being manifest of themselves, they suppose not any *prior* truths in the mind, whence they may be evidenced and explained. It is not needful to enlarge here upon the necessity of circumspection and care, in settling these primitive and fundamental perceptions. For since the whole superstructure of our knowledge rests ultimately upon them, it is evident at first sight, that a mistake in this case must at once overturn and annihilate all our future reasonings. But having already explained the nature of these propositions in the second book, unfolded the notion of self-evidence, and taught the manner of distinguishing between the truths of this class, and those that are demonstrable; we shall, for the present, wave any farther consideration of this subject, referring the reader to what is there advanced, if he desires fuller information.

SECTION XXIII.

Of the Application of Self-evident Truths in demonstrating such as are remote and distant.

The first and more immediate relations of our ideas being thus pointed out, our next business is to investigate such as are remote and distant. And here it is that we have occasion for intermediate notices, and a skilful application of intuitive truths. But though self-evident propositions be the ultimate foundationof our reasoning, we are not, on that account to imagine, that the art of improving knowledge lies in assembling, at random, a large and comprehensive stock of these. Even *general principles*, considered by themselves, avail but little towards the investigation of truth. They are, indeed, useful as *media* of certainty, by preserving the evidence of our reasonings distinct, which never fail to convince, if, being pursued to their source, they are found to resolve themselves into, and ultimately terminate in these principles. But when we set about the increase and enlargement of science, far other helps are required. For here the whole secret consists, in devising and singling out such intermediate ideas, as, being compared with those others whose relations we inquire after, may furnish out a train of obvious and known truths, serving distinctly to investigate the said relations. Euclid, in the first book of the elements has demonstrated, *that the three inward angles of a triangle taken together, are equal to two right angles.* The reasoning, by which he establishes that proposition, resolves itself into this general principle: *things equal to one and the same thing, are equal to one another.* Will any one, however, pretend to say, that a bare consideration of the principle itself led him to that discovery? The merest novice in mathematics, would, upon this supposition, be equally qualified for the business of invention, with one that had made the greatest progress; inasmuch as these general principles of the science are commonly known to both. But the truth of it is, Euclid, having found out angles, to which the three angles of a triangle, and two right angles, being compared, were found severally equal; thereby ascertained the proposition in question, by showing it to terminate in the above axiom, though perhaps the axiom itself was never once thought of, during the whole course of the investigation.

SECTION XXIV.

Reasoning, though resolvable into general Truths, rests immediately upon particular Self-evident propositions.

And here it may not be improper to observe, that though it be usual in reasoning, when we arrive at any particular self-evident proposition, to refer to the general axiom under which it is comprehended: yet is not this done out of absolute necessity, or for the sake of any additional confirmation. All intuitive truths, whether general or particular, standing upon the same foundation of immediate perception, are necessarily embraced for their own sake, and require no mutual illustration one from another. When, therefore, we have found, that the three angles of a triangle, and two right angles, are severally equal to the angles formed by one right line standing upon another, we thence immediately discern their equality between themselves, independent of the general axiom into which this truth may be resolved. Nor do we in reality refer to that axiom, by way of evidence and proof; but merely to show the coincidence of the example under notice, with a previously-established general principle. The same thing happens in all other demonstrations whatsoever, which, terminating thus in particular self-evident truths, are therefore of themselves sufficient to certainty, and acquire not any new force by being ultimately referred to general maxims. This I mention here, to obviate a common prejudice, whence many are led to imagine, that particular intuitive propositions derive their evidence from those that are general, as being necessarily included in them. But since they both stand upon the same foundation of certainty, and are admitted in consequence of immediate perception, they have therefore an equal claim to self-evidence, and cannot be made plainer by any mutual appeal.

SECTION XXV.

Particular Self-evident Propositions so called here, in Opposition to General Principles.

As, however, it is usual in the method of science to lay down certain general principles by way of foundation for our future reasonings; some will perhaps object, that this seems to be a needless precaution, since demonstrations may subsist without them, and commonly terminate in particular self-evident truths, peculiarly connected with the subject under consideration. In order, therefore, to give a distinct idea of the true design of this previous step, we shall begin with observing, that by the particular propositions in which demonstrations terminate, must not be understood such as are so, according to the strict definition of the word or in opposition to universals; but only confined and limited truths, when compared with others that are more general. Thus the proposition, *circles, equal to one and the same circle, are equal between themselves*, is, in strictness and propriety of speech, universal, because the subject is taken in its full extent, and the predicate agrees to all the individuals comprehended under it. We here, notwithstanding, consider it as only a particular truth; because it is of a very limited nature, when compared with the general axiom mentioned above: *things equal to one and the same thing, are equal to one another.* For this not only extends to all the various species of figures, but takes in every object without exception, that comes under the denomination of quantity.

SECTION XXVI.

General Principles serve, first, to contract the Bottom of our Reasoning;

This point settled, it will easily appear, that the method of premising general principles in the sciences answers these two great and valuable purposes. *First*, to contract the bottom of our reasoning, and bring it within such bounds as are sufficiently accommodated to the capacity of the mind. For demonstrations being carried on by means of intermediate ideas, which must always have some peculiar connexion with the matter in hand, the particular self-evident propositions in which they terminate, are almost as various as the subjects to which they relate. Thus, in investigating the equality of different objects, whether angles, triangles, circles, squares, &c. the intuitive truths, on which the proofs rest, always regard the particular species, and may be therefore multiplied, *in infinitum*, as well as the species themselves. But now it is remarkable, that all these several truths, numerous as they may appear, are yet reducible to this one general principle already mentioned: *things equal to one and the same thing, are equal to one another.* The same observation will be found to hold in other parts of human knowledge, insomuch that though the particular truths on which we bottom our reasonings, are really innumerable; they yet may be all, without exception, resolved into a very few general maxims, and thereby brought readily within the compass of the understanding. When, therefore, we begin with premising these general truths, and as we advance in science, take care universally to resolve our demonstrations into them; this must needs add a wonderful clearness and perspicuity to our reasonings, and by establishing them upon a foundation previously admitted, and of whose strength and firmness we are abundantly satisfied, give them that irresistible force and influence, which serves to produce absolute certainty. Nor can we possibly imagine any thing more elegant and beautiful, than thus to behold knowledge rising from a firm and fathomable root, bearing its head aloft, and spreading forth into innumerable branches of science; which, though variously implicated and entangled, and stretching to a vast extent, yet, by their union in one common stock, derive thence so sure and stable a support, that all the assaults of cavil and scepticism are not able to destroy or loosen their connexion.

SECTION XXVII.

Secondly, to ascertain the Justness of it with more Ease, and less Hazard of Miscarriage.

But, *secondly*, another purpose served by general principles is, that they enable us with less fatigue and labour, and less hazard of miscarriage, to satisfy ourselves as to the justness of those reasonings by which science is established. For since demonstrations, when pursued to their source, terminate always in particular intuitive truths, which are therefore the ultimate foundation of certainty; it greatly improves us, to beware, that we receive not any propositions under this name, until we have distinctly settled them in our own minds, and attained a full and clear perception of that self-evidence, on account of which they are admitted without proof. But now these propositions being many in number, and differing according to the nature of the subject about which our researches are employed, it must greatly perplex and retard our reasonings, were we to check ourselves every time they occur, in order to examine them by the rules of first principles. Nor is it a matter of slight consideration, that in the heat and hurry of demonstrating, while the mind is advancing eagerly from one discovery to another, we should be often tempted to pass them over hastily, and without that attention their importance requires; which must expose us to many errors and mistakes. These inconveniences are effectually prevented by the method of premising general truths; because, upon referring particular propositions to them, as the connexion is obvious at first sight, and cannot possibly escape our notice, the evidence is discerned to be the very same with that of the principles to which they belong. And thus by a bare reference, without the trouble of particular examinations, the grounds of reasoning are ascertained, and our demonstrations found ultimately to rest on maxims previously established.

SECTION XXVIII.

Of the Manner of linking Propositions together, in order to the forming of legitimate Demonstrations.

Having explained the use of general principles, shown them to be the great *media* of certainty, and found, that in order to enlarge the bounds of science, we must have recourse to intermediate ideas, as by means of them we are furnished with the several previous truths, of which reasoning consists ; it now remains, that we inquire in what manner these truths are to be disposed and linked together, towards the forming of just and legitimate *demonstrations.* We have seen already, in the preceding book, that *syllogisms*, drawn up according to the rules there established, lead to a certain and infallible conclusion. If, therefore, evident and allowed truths are disposed in a *syllogistic* order, so as to offer a regular conclusion, that conclusion is necessarily true and valid. And since in every genuine syllogism, if the premises are true, the conclusion must needs be true; it manifestly follows, that the conclusion already gained, being now a known and established truth, may be admitted as one of the premises of any succeeding syllogism, and thereby contribute towards the obtaining a new conclusion. In this manner may syllogisms follow one another in train, and lead to a successive discovery of truth ; care being always taken, that the premises, in every step, are either self-evident propositions, or conclusions previously established. And indeed the whole art of *demonstrating* lies in this due and orderly combination of our syllogisms. For as by this means all the several premises made use of are manifestly true, all the several conclusions must be so too, and consequently the very last conclusion of the series, which is therefore said to be *demonstrated*. The same order is to be observed in the disposition of the demonstrations themselves. That is, those propositions are always first to be demonstrated, which furnish principles of reasoning in others; it being upon the certainty of the principles made use of, that the certainty of the truths deduced from them depends. And since even the different branches and divisions of science have a near connexion among themselves, insomuch that the knowledge of one is often presupposed in another; great care must be taken to adjust the several parts with an eye to this dependence, that those may always come first in order, whence the *postulata* of demonstration in others are borrowed.

SECTION XXIX.

Why the Method here explained is called the Method of Science.

In this way of putting together our thoughts, it is evident at first sight, that however far we carry our researches, *science* and *certainty* will still attend us. But what is particularly elegant and happy in the method now explained, we hereby see knowledge rising out of its first elements, and discern distinctly how those elements are combined and interwoven, in order to the erecting a goodly structure of truth. *Experience* furnishes us with simple ideas and their names, which are the *primary* materials of thinking and communication. *Definitions* teach how to unite and bind these ideas together, so as to form them into complex notions of various orders and degrees. *The general principles* premised in science exhibit to the understanding such intuitive and fundamental truths, as express the immediate rela[illegible]ns between our ideas, and constitute the ultimate ground of certainty. *Demonstrations* link known and established truths together in such manner, that they necessarily lead to others which are unknown and remote. In fine, the duly adjusting the several branches of science and the demonstrations in every branch, lays knowledge so open to the mind, that we see the parts of it growing one out of another, and embrace them with full conviction and assurance. Thus are we gradually led from simple ideas, through all the windings and labyrinths of truth, until we at length reach the highest and most exalted discoveries of human reason. It is true, the method here laid down hath hitherto been observed strictly only among mathematicians; and is therefore by many thought to be peculiar to number and magnitude. But it appears evidently from what we have said above, that it may be equally applied in all such other parts of knowledge as regard the abstract ideas of the mind, and the relations subsisting between them. And since, wherever it is applied, it necessarily begets *science and certainty*, we have hence chosen to denominate it the *method of science*, the better to imitate its true nature and extent.

FINIS.